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ABSTRACT

This autobiographical essay depicts a process of development through which an elementary school teacher becomes both expert and professional. With an MA in Medieval History and no teacher education coursework, the writer adopts a personalistic, "unorthodox traditional" approach to instruction. Exposure to controversy among traditionalists and innovators and involvement in after-school discussions and weekly inservice workshops provides her with a first view of professionals at work on educational questions for which there are no simple and ready answers. Two years of subsequent participation in a Cambridge teachers' seminar, requiring microscopic classroom observation of children's encounters with materials and minute analysis of concrete instances of children's thinking, produces guidelines for managing classroom activity for cognitive outcomes. Then, first hand experience with a school system exclusively committed to behaviorist principles and direct instruction techniques provides clarifying contrast for the writer's emerging philosophical orientation. A need for conceptual integration and a rationale for classroom practice promotes an extensive reading of the Piagetian developmental literature from which she gains the ability to delineate differences between learning theory and developmental approaches to education. The essay continues with a description of the teacher's first cognitively oriented open classroom and a discussion of new questions emerging from her errors and her successes. (Author/RH)

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Kathe Jervis

CHILDREN'S THINKING IN THE CLASSROOM

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In November 1972, educators from several parts of the United States met at the University of North Dakota to discuss some common concerns about the narrow accountability ethos that had begun to dominate schools and to share what many believed to be more sensible means of both documenting and assessing children's learning. Subsequent meetings, much sharing of evaluation information, and financial and moral support from the Rockefeller Brothers Fund have all contributed to keeping together what is now called the North Dakota Study Group on Evaluation. A major goal of the Study Group, beyond support for individual participants and programs, is to provide materials for teachers, parents, school administrators and governmental decision-makers (within State Education Agencies and the U.S. Office of Education) that might encourage re-examination of a range of evaluation issues and perspectives about schools and schooling.

Towards this end, the Study Group has initiated a continuing series of monographs, of which this paper is one. Over time, the series will include material on, among other things, children's thinking, children's language, teacher support systems, inservice training, the school's relationship to the larger community. The intent is that these papers be taken not as final statements--a new ideology, but as working papers, written by people who are acting on, not just thinking about, these problems, whose implications need an active and considered response.

Vito Perrone, Dean
Center for Teaching & Learning,
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Nobody taught me to grow crystals. I taught myself.
Liza (Age 9)

1

Pre-Seminar

I entered the teaching profession without any strong feelings about how to teach. I taught fourth and fifth grade social studies for a year and then moved to a new job which coincided with the first "open classroom" in that school's history. I was teaching a traditional fourth grade, but I was exposed to all the searching that surrounds experiments. I was caught up in new ways of teaching, but I was still wedded to the idea of teaching the Greeks, hardly a topic children will spend a year studying if given freedom of choice.

When Bill Hull proposed the Seminar on Children's Thinking, I had taught fourth grade for four years. I was ready to look at classrooms in new ways and his seminar seemed to offer one. As it turned out, those Tuesday afternoons in Cambridge had a tremendous impact on me. This essay is an attempt to trace my growth as a teacher and to document the relationship between the seminar and my classroom.*

*See North Dakota Study Group monograph.

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Kathe Jervis has taught kindergarten-through-6th grade and at the college level in New York City, Boston and Los Angeles. During the last academic year, she led a seminar on children's thinking in Los Angeles.

FIRST YEAR FUMBLINGS

That I became a teacher of young children at all is an accident of geography. I did not want to leave my rent-controlled Manhattan apartment for the rural unknowns, which is where my new MA in Medieval History seemed to be leading. When I was offered a job at Dalton, a private school three blocks away, I jumped at it. I did not care that it wasn't the high school history job I had applied for, which might have made some sense for me. That I didn't know a nine-year-old from a six-year-old from a twelve-year-old and had never had babysitting or camp counseling experience did not daunt me. I was to teach fourth and fifth grade social studies.

My introduction to teaching was a June meeting on curriculum. I sat through the meeting numb to what was going on; at the end I was handed a xeroxed copy of my curriculum for the following year. It was a scrap of paper consisting of two entries. I still keep it in my jewelry box as a memento. It said:

Fourth grade: Creation, the Pygmies, Cave Men, The Bible, Evolution

Fifth grade: The Greeks

Since I had never heard of prepared curriculum or teacher aids or even schools which supported new teachers and helped them to develop their own curriculum, I thought this was the way it was done and plowed ahead.

I was helped throughout the year by enthusiasm and lack of condescension toward children (it never occurred to me to treat them less well than my friends). The children were notoriously bright and very verbal. I loved it.

What I did in my classroom had no relation to a well thought-out program. I remember (with some pain) having coffee during my break and wandering back to my classroom wondering what I should do that period. The school was departmentalized; the children had *nine* different teachers and my responsibility was to develop "reasoning skills." Since several other teachers required writing, I was not to do any writing. So we talked. There were very few books available for my classes and no one volunteered to help me scrounge some. So we talked some more.

But I was fearless. I called up Colin Turnbull and asked if he could talk to my nine-year-olds about the Pygmies. He was too busy, so I thought I would try Jerome Bruner. Somewhere or other I had heard about Bruner and his group at Education Services Incorporated (later Education Development Center) and when I was in Cambridge I went over to their offices and hung around. The unit, *Man: A Course of Study* had not yet been published, but it was available in bound notebooks which could not leave the premises. I camped out until I finished copying down as much of what looked interesting as I could and took these ideas back to my colleagues, who were impressed with my initiative and persistence.

Those events, however, were rare in my first year of teaching. Mostly it was unrelieved naiveté.

MY NEXT CLASSROOM: UNORTHODOX TRADITIONAL

My next job, as a head teacher in a fourth grade class, at Shady Hill, in Cambridge, was not the same at all. I was expected to present my curriculum to a committee, and to write up a summary of the year's work in a format consisting of aims, concepts taught and methods used. I still had neither goals nor philosophy. But here were bright, verbal children who could get excited about the Greeks and write and sing and put on plays. I did not spend much time teaching skills in a group, but my students read enough books, wrote enough compositions, talked enough about *The Iliad*, and put on enough Greek dramas so that their skills increased as measured by the standardized tests.

As I became more experienced, I made some minor changes. I was able to plan by the week instead of by the day. I decided that reading and writing and talking

were not the only ways to learn, and I added drawing and movement. I realized that giving children more choice produces more involvement. But I still guided the activities, set the room arrangement, and provided the materials.

There was no choice about teaching Greece--that was the nature of fourth grade at Shady Hill; it had been since 1917. But I worked hard at adapting the subject matter for the children in my class. Instead of introducing *The Iliad* as the story of Achilles' anger over his lost mistress, I developed an elaborate analogy about lost hockey skates, a much more believable cause with which to identify. To demonstrate the effects of hereditary privilege, the class drew lots at juice time to determine the amount of juice and the number of crackers each child received. To provoke a discussion on the advantages and disadvantages of tyranny, I became a tyrant during clean-up time. The children were petrified, but the room was never cleaner and the discussion of authority was lively.

In addition, I willingly left time for those activities which sparked the class. Once I spent weeks of valuable class time discussing and codifying the rules of a brutal recess game the children had invented. We spent a fair amount of time talking about sex, and another year the class started a major letter-writing campaign to protest the inhumane treatment of animals. Considering that I did almost no formal teaching of skills, had no predetermined goals and was very relaxed about the pace of the year, my classroom was still very teacher-centered; all assignments and information emanated from me. I suppose this mode of teaching could be labeled unorthodox traditional.

THE INNOVATORS VS. THE TRADITIONALISTS

Any philosophy I was developing was a response to the specifics of my teaching situation. Since I had never taken education classes, I never had any education school formulas in my classroom. I had no standardized curriculum, no pat solutions, no fantasy models of the perfect teacher, and no theory to get in my way of looking at children. Instead I had small classes, support from the administration and school psychologist, and a faculty known for its excellence from whom I could choose role models.

The faculty had much to offer, but for me the excitement was generated by a small group of pioneering teachers who had been very successful with their old methods, yet who wanted to explore a new way. Though I didn't grasp all the implications of what they were discussing when they met after school, it was my first real view of professionals at work. I gravitated to this group because they were accessible, and I was groping.

Even had I been more sure of the innovative

direction my teaching would take, observing them and their growth was the only way at that time to learn about the British infant school model they were using. In 1967, there was not much to read except a few curriculum guides from England, no well-established classrooms to visit, no university classes to enroll in; there was only the company of these teachers who had been to England and had decided to try the new methods on their own, with each other and occasional visitors from England to refuel them. Although my classroom stayed essentially the same, the atmosphere of their exploration was intensely involving.

Outside my classroom I was exposed not only to their late afternoon rehashes, but to those on the faculty for whom this movement was a whole new theory in educating children. It produced in curriculum committee meetings, at lunch, at faculty meeting teatime, the kind of heated discussion accompanying any new movement that goes against some of the basic principles which have been held inviolable for years.

What was discussed after school was how to get Jane to write a caption on the picture she had just painted; how to get Tim to spend more time reading because he wasn't making any progress; how to get that group of three boys to broaden their interests beyond spaceships, what to do about Liza who had floated for three days in a row? Or should Jeremy, who had been in the woodworking corner for a week, be encouraged to move? They discussed specific events; they did not discuss philosophy.

The traditional teachers talked in global terms and tended to evaluate the new program for what it was not. It was not strong in social studies, up to now the strength of the school. The global question was--is there an agreed-upon body of knowledge which every person should possess? A study group for three weeks on birds could not compare, in my mind, at the time, to a full year of the Greeks replete with mythology, Greek art, drama, archaeology and a chance to compare the details of one's own daily life with those of another culture. In a traditional social studies program, reading the literature, identifying the heroes, and examining the issues which touch the human condition now or in the past were experiences I valued for the children I taught. But, said the innovators, is an understanding of the Greeks (or the Vikings or the Egyptians or outerspace or any subject, when it is chosen by the teacher and not the children) crucial? Isn't the ability to choose and to ask questions and pursue answers more important than the body of knowledge itself? Does the teacher have an obligation to expose children to subject matter even if it curtails opportunities for a child's initiative?

About this time, I took a summer course taught by one of the originals from Leicestershire. In a discussion of this issue, she asked me what I did with the children who were not interested in Greece. I was startled. A child in my class not interested in Greece? That was inconceivable. Or was it?

I have a vivid recollection of a curbside discussion the following year with one of the innovative faculty members. I was telling her about a particularly good discussion my class had had. She asked me how many children had participated. I said about eight (out of 20). She asked whether they were always the same eight. I had to admit they were. "Well then," she said as she drove off--leaving me to my own conclusions. That chance exchange forced me to reexamine the animated, verbal discussions I had always valued. The 12 children who did not participate--were they really so interested in Greece? What were they getting out of our year-long study? Would it be better for them to find their own subjects, even if their study was relatively superficial? A related question was how could one teacher be prepared to provide for 20 different topics the kind of knowledge and creative curriculum ideas I brought to the Greeks? I concluded, correctly, that they couldn't. But my way of looking at the work involved clearly showed that I did not understand some of the basic premises of open education.

Another weakness of this kind of classroom was the children's increasing lack of technical skills. The teachers of the older children complained that as more and more of the children experienced the new classrooms, their handwriting, spelling and reading deteriorated. The issue was the sacredness of the written word. On the other hand, innovators valued a construction as much as a composition, especially if the child had set himself the task, planned the project, collected the materials, and executed it in a craftsman-like manner. Would the children ever reach high standards of written communication if formal skills teaching were abandoned? Does the increased initiative, independence, and self-confidence balance the bad spelling and handwriting? Does there have to be a tradeoff at all?

This was another perplexing issue for me. In my scale of values, I could not justify spending large hunks of time with handwriting exercises when one could be writing a story instead. Reading and writing about Achilles seemed to me better than having a phonics lesson on blends. It was not that I was so sure my way worked, but that I really didn't know how to run a reading group or structure the teaching of phonics. So even if not by reasoned intent, I was in the camp of the innovative classroom teachers on this issue of formal skills teaching.

Another issue, somewhat related to the place of the written word in the curriculum, was the "academics vs. the extras." Why, the innovators wanted to know, was there this division anyway? Why was art less valuable than writing? Why, as soon as children reached the age of reading and writing, did the school relegate art to the afternoon and save the mornings--when the children were presumably freshest--for the heaviest skills teaching? Why did the school rush a nonreading child to

a tutor and ignore the deficiency of a child who couldn't draw? What was the classroom doing to the ego of the nonreading child, especially when that child was very musical or artistic or had some other special qualities which were neglected as the fact of his nonreading loomed larger and larger?

This argument grew into the larger issue of the very propriety of subject-matter divisions. After all, another name for what the innovators were doing was "the integrated day." Why should children leave their regular classroom to be taught art and music and be given the message that these subjects were not a part of their daily classroom life?

As the innovators encouraged the faculty to include all subjects in their teaching, I was ready--in theory. In practice, I was hopeless, inadequate, and frustrated. No matter, the innovators would provide inservice workshops for the faculty. They were not required, but everybody went. These workshops were agony for me at first, but gradually I gave way. Not only was I asked to compose music on the Orff instruments, but I had to sing and dance as well. It seemed impossible, but I did it. As the faculty developed more enthusiasm, the workshops became regular Friday afternoon occasions and functioned like any well-run open classroom. I actually wrote a poem, I built a model of an imaginary city I formulated my own math problems and I tested my ideas out in the science area. I learned to deal with the panic of not being told exactly what to do. I grew slowly, but these workshops were crucial to my own learning.

When I resigned, five months pregnant, I had no clear understanding of "an open classroom." I had a vague idea of a few issues which divided teachers, a vicarious look into some of the daily decisions teachers in informal classrooms were asked to make, and I knew about some of the standard activities which occurred in such a classroom. I had a picture of what this classroom looked like--tables, rugs and couches instead of individual desks, sign-up sheets instead of assignments, class pencils instead of children's own pencils, and displays of children's work instead of didactic bulletin boards. I knew some catch phrases--"Children need to take responsibility for their own learning," "Children need to learn to make meaningful choices," and "We must look at individual children's needs." I had experienced this kind of classroom on an adult level. Had I attempted my own "open" classroom at that time, I would have failed more than I did my first year of teaching. I neither understood the underlying philosophical principles of an "open" classroom nor conceived of the complexity the teacher faces in running such a classroom.

What is particularly striking and very odd in retrospect is that in my attempts to come to grips with some of the philosophical issues I was exposed to, I never considered the most obvious criterion--how children think.

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The Seminar: How Teachers Think About Children's Thinking

It was at this point that I joined Bill Hull's seminar on Children's Thinking. I saw the announcement in the bulletin of the Greater Boston Teacher Center, an advisory encouraging innovative classroom teachers, but that was all I knew about the seminar.

The ten experienced teachers who responded were willing to meet weekly--for no money or no credit--and shared a commitment to examine their classrooms. There was never any philosophical discussion or any labelling of teachers as open or not. As it turned out, the philosophical spectrum of the group was narrow, but I did not find that out until long after I had left the group.

Two criteria for membership shaped the group. First, to generate fresh examples of children's thinking, it was necessary to be working with children (I volunteered to teach math in a fourth-grade class room, but all the others were full- or part-time teachers.) Second, no two teachers could be from the same school, thus compelling each person to describe his/her teaching situation fully and avoid the shorthand communication common to people who teach together. Because no one had witnessed anyone else's classroom, no one could take exception to another's descriptive statements.

INITIAL EXPECTATIONS

It was clear from the very beginning that Hull believed that teachers who handle complicated classrooms are capable of quality thinking themselves. He conveyed the message that teachers were a valuable source of information about children's thinking. Not only good teachers or experienced teachers, but all teachers were resources, mostly untapped.

Bill's attitude was a subtle key to unlocking teachers' abilities to observe and analyze children's mental activity, but the constraint most responsible for channelling these observations into new formulations were the firm rule: *Stick to examples.* No theoretical tangents were allowed. Anyone who was tempted to generalize was politely encouraged to "Write about that idea--it sounds so interesting." Dealing with specifics became so ingrained that anyone who made a general statement was immediately asked to "give an example."

Two additional expectations were set, but they did not significantly influence the beginning stages. One was regular disciplined writing as an aid to analysis and reflection. The other was a conscious listing at the end of each day of everything that could be recalled.

FORBIDDEN TERRITORY

The constraints of the seminar excluded school politics of any variety on the grounds they could not be dealt with as fruitfully as the everyday realities of one's own classroom.

No child was ever clearly identified. Nor were any child's emotional problems discussed in depth. The issues of what to do about Jesse who harassed other children or Carol who had nightmares came up in discussions on harassment or children's fantasies, but the focus was not on how to get Jesse to stop his aggressiveness or Carol to cease her nightmares.

There was no place for gossip or personal problems. Only once in a while did the group discuss whether the seminar functioned as a support group. Most members agreed it did not. There were no long discussions about how we felt about each other nor involved exchanges about the process.

Above all, there was a sense of professionals at work.

THE MEETINGS

Teachers arrived after a full day of teaching. There was a short socializing period as the group gathered over tea and cookies and settled into comfortable chairs in Hull's living room. The group felt strongly that a non-school setting was important--if they were to focus all their attention on the classroom, they didn't want to be sitting in one. (Some distance was needed to maintain sanity.)

At the first meeting, Bill gave us a guideline for proceeding:

> Each teacher should be prepared to supply one or more specific instances of a child's or a group of children's thinking, problem solving, or mental activity of any sort for each session. The particular situation or event should be described as clearly as possible and a record made of it in notes or on tape which can be transcribed at a later time. The instances should not be confined to any one subject area and should include problems encountered in everyday living. Any information which may bear on the particular situation should be included.
>
> These accounts should include failures as well as successes, problems which are incidental as well as

those relating to curriculum, self-chosen problems as well as those set by someone else.

Ideally, each teacher was to produce a written account. In fact, not every account was in writing. There was no prescribed order of presentation. "Who has an incident?" was the signal to begin, and someone would narrate an event or distribute the written version to be read silently. The account did not even have to be articulated clearly. The narrator often didn't understand what was puzzling about the incident and only had a vague feeling that it was provocative and needed elucidating. The members asked questions, the narrator furnished the details, and others recalled similar situations. The puzzle emerged more clearly as 10 different points of view focused on one concrete example. It did not necessarily produce a solution, but no one thought of this group as a place to find final solutions, so there was no pressure to come up with one. When the comments about one incident were exhausted, we moved on to the next.

At that first meeting we discussed persistence. What makes some children keep trying and others give up? Can tenacity be taught? What influence do the persisters have on the rest of the class? Is persistence sometimes only dutiful acquiescence to the teacher? In keeping with the guidelines, we stuck to specifics. There was Steven who always said "I never give up!" (and he didn't) and Michael who was pained everytime he met an obstacle. What about Danny who left an unfinished spaceship on the shelf for days, but in the middle of building a volcano when he was all covered with wheat paste, he had a beautiful idea about finishing his spaceship? What kind of classroom accepts and encourages children to delay finding the solution to a problem? Does feeling a pressure to come up with a solution right away make children give up?

Shifting focus, dealing with variables, solving problems, making mistakes, misperceiving--all these aspects of children's thinking were examined concretely. There was John who worked with mirrors for three long work periods but at the end could not see the back of his head using two mirrors. Why? Jane couldn't apply the phonics rules she was taught. Why? Is direct instruction ever effective? When does it provide the child with a clue that unlocks a whole world of new learning? How does a teacher provide depth? What about the balance between spur-of-the-moment happenings and long-range planning? Do informal classrooms have too little content? These are the kinds of questions which grew out of concrete examples and provoked the group's thinking.

The members learned to explain incidents more completely, ask more astute questions, and listen to each other to a degree rare in educational gatherings. Examining other's instances and searching for their own to present led teachers to look at their classrooms more

critically. The process was cyclical--the more careful the observations, the more insight produced; and the more insight produced, the more careful the observations. An opportunity for growth was embedded in the structure of the seminar. Teachers developed the ability to observe and analyze regardless of the content.

As the group became more skilled in working together, one incident--rather than one from each person--could occupy an entire session.

COMMENTARY

The meetings were lively (though we learned to tolerate silence) and tired teachers revived during the animated discussions; everyone agreed it was a stimulating and refreshing two hours. But the seminar might have been no more than a pleasant memory of good discussion, which produced a few more articulate teachers who taught themselves to observe on a high level, if we had made no provision to keep a permanent record.

It worked like this. Each meeting was taped, and then someone (at first Bill Hull and then others) listened to the tape, summarized it, added comments and prepared it for distribution to the members. It was not merely a secretarial transcription. The commentator sifted and filtered what was on the tape. There were no constraints on the commentator--any comments, ideas and wild speculations were welcome.

When parent conferences, snow storms and emergency faculty meetings cut into attendance, the written commentary allowed absent members to be vicariously part of the discussion. But that was only a superficial function of the written record. The Commentary revealed much more depth than was apparent at the actual meeting. If an insight was fresh, it took root the first time. The Commentary insured that these insights did not get lost. Relationships between discussions were not always obvious, and as issues emerged and examples recurred in different contexts, the Commentary captured the labyrinthine progress of the group's thinking.

Example

Here is a typical example, which demonstrates how issues emerged from incidents, and how they appeared in the Commentary. I was the "leader" that day, but I did not write this Commentary (Hull, March 12, 1974, "Notes and Commentary" pp. 245-250, unpublished), which is a complete record of the session. It begins, as usual, with an account of an incident. The specifics were bulletin boards, display tables and plan books, but the example sparked a discussion on a recurring theme of anticipation and reflection. The implicit question, as usual only vaguely sketched in, was how can bulletin boards help children to rethink what they have done in the classroom and help them plan for the future? How

can a bulletin board raise the level of thinking, planning and reflecting?

The Incident was presented by Judy Higbea.

A major "success" in our classroom has been the bulletin board, upon which announcements appear with regularity each morning. These announcements range from the general to the very specific, including offerings for the day, or week, and provide reminders of scheduled specials, i.e. music, P.E., art. There are also frequent opportunities for sign-ups, such as a cooking group for the next day, or a study group for the next few weeks, or chess tournaments. When the children enter the room in the morning, most of them head immediately for the B.B. with pencil in hand. For a while, I made a conscious effort to restrict the sign-up notices to an irregular appearance, for obvious reasons.

The B.B. has significantly organized our lives in the classroom and I think keeps it that way. While it has varied in its scope (one day it announced that it was sign-language day from the moment of reading), it's often redundant. We touch on most of the announcements in some way or another during the day, but everyone is much more informed than if they hadn't read the signs.

Sean has used the book, in which we keep all past announcements, to reminisce; he can barely read, and yet each day he asks to put the old slips into the book so he can pore over it. Other children also use it to recall, but not so extensively as Sean.

As the group takes on more responsibility in the room, they very naturally are taking on more responsibility for the B.B. as well. At times, I've even noticed signs that I hadn't read--perhaps my diligence in reminding the students to read it should be turned around.

The Discussion:

We have talked before of anticipation and reflection. A good deal of our experience washes over us, leaving us with certain dispositions, perhaps, but with very limited access to what has happened to us in the past. There is a sense in which we need to learn to be our own historians. How does one explain infantile amnesia if you don't believe in Freud's repressions? It seems likely that children have to learn the structures in which memory can exist. Can you recall experiencing something and at the same time having the awareness that you are going to tell someone about it later? Such dual level awareness alters the experiencing. The

construction of a personal history is closely related to the development of self-concept, in Lecky's terms, and it may be very productive for us to see how this can operate in the classroom. Why is it that most of us draw an almost complete blank when we try to recall our early school years? Is this good or bad?

The group agreed that the bulletin board can be a very strong stimulus for those learning to read. All kinds of uses are made of it. Children who had signed up to visit a sick classmate checked to find out what day they had chosen. Other children would check it for the spelling of particular words. Signing up for a work group became so popular that Judy found children signing anything that had lines on it, without reading. She took care of this by varying the lists: I agree to sweep the room after school today. The good readers tend to sign up for their interests first. Some get to school early when they know that there is a limited-enrollment group being established. Betsye sometimes limits choice by specifying, in advance, the composition of the group: two eight-year olds, two seven-year olds, two un-specified, but equal number boys and girls. Such constraints lead to careful reading and sometimes negotiations. Kathleen likes all interested children to sign for study groups, even though not all can be accommodated. If there is a strong interest ways of sharing can be worked out, a second group can be formed, etc. It is worth while having an indication of children's interests and in making it clear to them that their interests are important.

Display tables serve some of the same functions as a bulletin board, particularly when the children are doing them and writing the labels. If items are changed frequently children will make it part of their routine to check every day. "Decorated" notices may attract attention but are not always necessary. Inconsistency here may be a virtue.

The bulletin board book, containing past notices, is particularly useful for visitors or for those working in the classroom occasionally. Also it helps compensate for adult-amnesia. What did you do last month?

Betsye has observed children reading over past notices, singing birthday greetings as called for, re-living what has happened before with great good-humor. What has happened in the past does influence the future, particularly if you have a way of getting back to it in your mind. What are other kinds of representations for a personal or class history? One teacher uses a Polaroid camera and now has an

important pictorial record of significant happenings, constructions, high points, low points, etc. Meg keeps a book of things made and tries to include a large portion of things which are constructed. Sketches and descriptions help capture what has been done. The process of recording can help a child be more reflective and may also help him plan more carefully in the future. Meg will often ask if someone has built something. Otherwise she is apt to miss it.

Kathleen's plan book for shop is also very useful. Children often get ideas from things others have made and the sketches which they have drawn can serve as useful reminders of alternatives. The picture with dimensions indicated is up on the wall while the project is in process and later is filed in a book.

Meg has found the wood-work-planning-book essential in helping children slow down and entertain alternatives. They are apt to seize the first piece of wood that hits their line of vision otherwise, planning their projects by what is available rather than starting with the idea. Much less wood is wasted when they work from a plan.

Betsye cautions that one has to be pretty clear about what the purpose is in setting up some of these routines. Requiring certain forms can be deadly unless they eventually are serving a real purpose for the children and are taken over by them. It is all too easy to get into the trap of making things look good for visitors, whether or not it serves any real function for the children. Harvard used to require its elementary MAT's to put on bulletin board displays monthly. These became a tour de-force for many and quite intimidating for others. This teacher-planned teacher-executed production is quite different from the concept of a bulletin board as one of the nerve centers of a classroom for which the chidren take a good deal of the responsibility and which eventually begins to take on a life of its own.

At this point someone free associated to Bobbi's charts. Bobbi has charts all over her room, about fifteen of them. Each chart is headed by a question with answers written below. What relation do the charts have to bulletin boards? Bobbi said that this was the only way she had discovered of being on top of the organization of a class of this sort. She started doing this to help with discussions, particularly to help children realize that it was o.k. to have different ideas about the same question. She usually writes down what different people say and does not push for any resolution. Ideas are

listened to more carefully and students keep thinking about problems which are raised. "Why do you think people are mistreating the animals?" "How can we get them to stop?" are examples. It is not necessary to be moralistic or to mediate in things of this sort. Writing down anything that is said gets it out so that people can think more about it and to consider alternatives.

When the energy crisis was first in the news a group of children in her class worked up a questionnaire which they sent home about the types of electrical appliances people had. Hair curlers, electric can openers, etc. They then made a chart of the whole thing, listing about sixty appliances and the ones each family had. (Not necessarily a matter of prestige?) This was an on-going project. They kept adding to it. How about figuring out how much current each appliance draws? Self-defrosting refrigerators, electric heaters use a tremendous amount of current, whereas small electric motors and light bulbs use relatively little. Flourescent lighting is much more economical than incandescent, etc. What would happen if available electricity were cut in half?

It sounds as though the whole room has become a bulletin board. It is useful to have these things on paper instead of the blackboard, because they can be rolled up and re-used. Other lists are checked frequently, such as the lunch room order, or the sign-up sheet for the "stage".

It is very important to get things which children are going to read at eye level. Very careful reading is done sitting on the floor or on top of a ladder or platform when the print isn't too far away.

One girl in Bobbi's class made a book about the charts. The charts seem to have taken over the role of the blackboard with the advantage that there is much more space available and nothing needs to be erased. They are great for helping to hold things together when there are many diverse activities going on.

Meg finds that charts are useful for younger children as well. She brought in a number of small whiskey bottles and posed the problem of how many different ways they could float in a goldfish bowl. Children would say to each other, "I can do A." "C is impossible!" "Have you done B?"

Though every person reacted differently to discussions depending on what was new or most useful at the

time, I, being the least experienced, took a lot from almost every discussion. These are the points which influenced my thinking:

1. The bulletin board as an organizational device--a nerve center of the classroom.

2. Ways of documenting class history which help children remember their past experiences.

3. Bulletin boards as a stimulus to reading.

4. Sign-up sheets as an exercise in classification.

5. The class history as a representation of experience.

6. The class history as an influence on future action.

7. The plan book for construction--another vehicle for using differing system of representation.

8. The bulletin board as a teacher produced phenomenon which prevents children from taking responsibility for their own environment.

9. The bulletin board as an opportunity for children to take charge of their own planning.

10. Charts as a way to formalize children's differing points of view.

Interestingly enough--it even may be an essential part of the success of the seminar--what worked in the classroom was often similar to what happened in the seminars. The class history served the same function as the Commentary--to remind children how much they had accomplished, to provoke new thinking about the past and to stimulate future thought. The charts like the Commentary, provided a permanent record of alternatives to be reconsidered over time. The discussions which led to the charts were an opportunity for all opinions to be heard without insisting on immediate solutions, just as were the seminar sessions.

After the bulletin board incident the group moved on to a discussion which occurred in Meg Atkin's first and second grade class:

What Makes a Bird a Bird?

When the class tried to name as many birds as they could they came up with 19 kinds and then dried up. However the challenge to get 25 kinds (the number of children in the class) was soon met. The list of birds is now hanging on a bulletin board with a note saying: "can you think of any more? Write

them down." Within the next 2 days several new names (and old ones already on the list) had been added. Interestingly, although we have many books about birds on display in the classroom at the moment, it seems to me that the new names added to the list were recalled, not looked up in the books. During the first naming one 7-year-old boy suggested "bats" and was immediately informed of his error by about half the class, but a 6-year-old did comment at this point that he wasn't a bit interested in birds, but that he was interested in bats.

At our next class meeting, I began reading the class the book "What Makes a Bird a Bird." It was written in question and answer form so we tried our own answers before reading the book's. "Is a bird something that flies?" The class immediately came up with airplanes, helicopters, rockets, blimps and balloons as counter-examples, then after a pause someone suggested the world. I asked them for examples of living things that weren't birds that flew, and they came up with the same examples as the book. The book throughout, in fact, confines itself to the set of living things, where as the class in their considerations repeatedly drew examples from the set of non-living things first. When we got to the question was a bird something that sings, they began listing juke boxes, televisions, record players as counter-examples and were rather stuck at first for examples from the set of living things. The first suggestion was elephant! When we came to the final question in the book, "So what is it that makes a bird a bird?" written across a page showing a magnificent peacock, several people thought they knew of something that all birds and only birds have. I asked a 6-year-old who looked as if she had been holding her knowledge of the secret from the beginning of the discussion. She said that the peculiar characteristic of birds was that they had beaks. This wasn't the book's answer but the class couldn't come up with any counter-examples. I mentioned the duckbilled dinosaurs and the beak of a dolphin andthese were accepted as counter-examples. The next suggestion of a peculiar characteristic was a bird's legs but somehow this suggestion was never examined, as the point of the peacock had been suddenly seen and several people were shouting "feathers". We didn't, however, take the book at its word and the class was very pleased with itself when someone suggested mattresses, then pillows, then coats. The meeting ended at this point but I did hear a 6-year-old muttering to himself, "then what makes a mattress a mattress?" and this in turn gave me pause for further thought. It reminded me of the philosophic dispute about naming. Hadn't the book's first question "what makes a bird a bird?" led us unwittingly into the idealist

position that things that are called by the same name have one peculiar property in common, which isn't perhaps a very helpful way of looking at naming and classification, even though it had been fun and thought-provoking looking for defining characteristics? It suddenly struck me that it was a bit of a silly book!

We have talked about the difficulties children have in understanding simultaneous class membership and in shifting focus from one attribute to another. These children seemed to be doing very well indeed, though the un-evenness is not surprising. In most cases there is not a single defining attribute. It might be fun to make this explicit. What does make a mattress a mattress? It is likely that familiarity with thinking of possible uses for an object is very helpful here.

From this discussion I was left with:

1. An example of a study group.

2. A sharper focus on children's classification abilities, especially the absence of negatives--no one thought of naming birds that don't fly.

3. An example of how classification was incorporated naturally in the curriculum.

4. A model question--what makes a_____a_____?

The discussion of birds was short, but provided an example which was used in other contexts to illuminate children's attempts to classify.

The last topic in this session was summarized in the Commentary. The specific example, the repetition of a batteries and bulbs unit, was omitted. The discussion concerned what happens when teaching plans are too contrived and children don't respond to suggestions? How is an activity different when the teacher has in mind what *should* happen instead of what *could* happen?

It is interesting to look at those activities which were one time very useful and at a later time have become much less good. I used the example of a fifth-grade Central Subject, world geography through the study of great explorers, combined with bookbinding. This became more and more ambitious, more and more controlled, until the zest had pretty much drained out of it.

Ricky suggests that there may be quite a difference between an emerging tradition and one that is dying. If so, how do we keep emerging, re-creating?

The examples held up by the Nuffield science group may be misleading. Some very good things do happen without too much contrivance. You can *help* some of these good things happen, but you can't *make* them happen. How about the transition point between the teacher's instigation and the time ideas, procedures, practices, become incorporated into the life of the classroom? It is a mysterious thing, but one has to be patient above all else. Children who have had opportunities to develop their enthusiasms may be considerably more ready and flexible in moving on to new levels.

Bobbi: I find that when I am sure in my own mind what I want to happen that it changes the process. It is much more important to keep *really open* about where something is going to go.

One is able to justify such openness on the basis of past experience. In order for the class to take things on as their own, time and trust are needed. Anxiety destroys such openness. Isn't this the history of the decline and disappearance of progressive education? Anxious parents and anxious teachers opt for the kind of results that can be produced on demand. If you are not getting them you better push the right buttons, turn the right screws, increase the pressure.

The teacher who foresees all sorts of splendid things which might happen is up against it when her/his suggestions just don't "take". When you push your own ideas under these conditions you may produce visible results, but how authentic are they? How do you tell? How much does the zest of the class count for? How can you support student enthusiasms which don't move you or move you the wrong way? (Remember the fashion show!)

Bobbi: I think there is stuff you can decide about conceptually. You can decide in advance *what* you want them to get without having to specify *how* it is going to come about.

For me, this discussion was one more powerful argument in favor of openendedness and flexibility. It was not just this particular session, but many over the two years which persuaded me to value curriculum with no predetermined results.

Each week, the meetings and Commentary provided new learning. Small details of curriculum, classroom management, and children's mental activity seeped into my consciousness. I stored in my head vivid examples which changed my teaching. I collected a repertoire of situations I have never encountered but can draw upon when the occasion arises. When I plan curriculum now, I

do it with an awareness of options. When I consider how to use bulletin boards, it is with all the experience of 10 people's ideas in mind.

LEARNING FROM THE SEMINAR

Neither the commentaries nor the discussions were tightly knit. The group tolerated randomness and valued ambiguity. But in time a logic did emerge. References to particular incidents showed up in different contexts--to illuminate new points, to support old ones, or just for the sake of repetition. Here is an example which originally demonstrated the need for supporting dubious endeavors in creative dramatics; it was referred to in an example of the Commentary on the previous page:

> Bobbi: I think I have learned to support myself, to be able to even let some things go on which I disapprove of. The children put on a "fashion show". I was just horrified at the idea of my girls getting up on stage and showing themselves off. I read to them everyday just before they go home to calm things down. I began to select things about little girls, wearing dresses and what that was all about, but I didn't make a big deal of it and did say that I would sign up for the auditorium. They wrote a note to go home saying, "Dear Mothers: Please have your daughter bring in two good dresses and one good play outfit for our fashion show." They were going to invite the whole school. I said that it would be much too crowded to invite the whole school, but they could invite a few classes. I decided that there was no way they could get it off the ground. I didn't say they couldn't do it, but I didn't discourage it or get excited about it. They asked me to be in it and I declined. One day they said they were ready to put on their fashion show. I asked to see a rehearsal of it, thinking to myself that I didn't want to make a complete fool of myself in school. It was incredible. I couldn't imagine when or how they had planned it. We made a movie of it. One girl got up and said, "Rosie is wearing blue seersucker pants, from Sears, permanent press..." --stuff that I never ever suspected they knew. This went on for forty minutes. Letting them work through that stuff was important. Then they were ready to talk about clothes. Before this I couldn't get them to talk about it. I think there have been times in the past when I have stopped things like this. I could have said, "I don't think girls should do fashion shows." They could talk about their feelings, what it was like doing a fashion show and have everyone watching you. This goes into other areas. They have learned that any play they do is

o.k., that they can come up with horrible stuff, they can kill rats, kill babies. I sit there and sometimes I will ask them something, but I really have become totally nonjudgemental. I don't say anything about it at the time. If I think it is important I will try to bring it up in a different way but not react directly to their play. I think that this has helped them a lot about being just totally free about coming up with anything. I feel it *really* is important for them to work these things through. Other people will be surprised at some of the violence. Somehow they are making better sense of it and they seem calmer. There seems to be a calmness about them that wasn't there in the beginning.

"Remember the fashion show!" was shorthand for the teacher's role in withholding judgment, setting the stage for contagious enthusiasm, and initiating, preventing, and controlling activities. The value of the seminar came not from any individual session, but from the accumulated examples and shared framework. In the development of the seminar no one expected issues to be dealt with once and for all, and major issues surfaced and disappeared only to appear again with new examples. The members saw coherence in apparent chaos.

This was demonstrated one day when there was a guest. The incident presented concerned a check list (a contract or whatever one calls the piece of paper that children are given with suggested assignments and the requirement that each task should be checked off as completed.) After ascertaining the details of this particular check list, members recalled all the other check lists they knew of, discussed the pros and cons of each one, and the merits of having a check list at all. The guest, who had heard raves about the seminar, was put off. He expected to talk about cognition, not check lists. The group was surprised. Though it had not been apparent to the guest, the topic had been (again!) anticipation and reflection. The question had been: how does a check list inhibit or encourage reflection? Why are there so many examples of children who can't remember what they did at school today? Does a check list help them remember? Is it important that they remember? For whom should they be able to recount their day? Their parents? Themselves? These were the same questions which faced the group when the specifics were bulletin boards.

The group, so to speak, was all over the map. But there was a commitment to focus on one's own experience, and concrete examples served as dependable landmarks which allowed the group to roam without getting lost.

One might well ask how a visitor could miss what was being discussed if the seminar members understood? If the discussion was grounded in the concrete, why was it so obscure? The group members had described their teaching situations thoroughly and had a clear picture

of each other's points of view where a visitor did not. This and the tendency to abbreviate concepts by references to examples ("Remember the fashion show") speeded up discussion and could have caused a short circuit in an observer's perspective. However, these two aspects are minor compared to the "sparked connections" that an observer would not see. The group was in the habit of playing one idea off another--each member viewed the example in a different way and each reaction sparked another. When digesting our guest's response, we spun off ideas which were not verbalized during the session. I can remember connecting the idea of check lists to journals. Would different expectations about writing journals have any effect on the quality of work which children produced? Or on the quality of experience during a work period? I also wondered whether the ability to anticipate a day's work relates to the ability to anticipate the movement of a puck on the hockey rink or a reaction of a child who has just been called a dirty word. The connections that were sparked were not always explicit, obvious or predictable. Children and adults take from a situation what they need, and the more connections that have already been made, the more connections they make. The members of the seminar, who had a reservoir of pertinent examples, were more sparked by the discussion than the visitor, who had none.

If the discussion was based on examples and we refused to generalize, how could we ever answer any of the questions we posed? Because we reached no consensus, it looked as if the seminar yielded only personal answers. But it is the method as much as the content which enlightens. Used to microscopic observations and minute analysis, we were confident that sticking to specifics, not generalizing and not forcing a solution, would provide enough insight to allow us to act while we continued to search for more evidence.

The seminar methods taught me that helping someone solve a problem involves careful listening and good questions, and that offering solutions can cut off thinking. I learned to rely on the concrete. My appreciation for the concrete has been so ingrained and my distrust of generalization made so deep, that I am often the one, in a discussion riddled by abstractions, who returns some focus to the group by asking for an example. The continuing weekly meetings, the slowly emerging issues which lent themselves to repetition and elaboration, and the Commentary, which was always there for rereading, rethinking and reviewing new ideas that had yet to penetrate were valuable components of the seminar structure.

I learned a tremendous amount from the structure of the seminar, but its content had a more dramatic impact on my teaching. I was essentially untrained when I joined the seminar. I had stumbled through my first few years of teaching by hard work and enthusiasm. In the seminar, I had listened and asked questions and

taken pleasure in being in the company of experienced teachers, but I had had a long way to go from my nebulous nonphilosophy to goal-directed teaching. At the end of two years, I felt (for the first time) like a member of the teaching profession.

The awareness of what was involved in managing a complex classroom where cognitive activity was stressed came gradually. The issues I had faced at Shady Hill (teacher-initiated vs. self-chosen curriculum; integrated vs. specialized subject matter, and the controversy over formal skills teaching) were not the crucial ones, at least as I had perceived them then. For example, I had worried that I could not provide the intensive preparation for all children in the class if they were pursuing different self-chosen subjects. I had no faith that they could set themselves problems and test their own ideas. Now, because of repeated examples in the seminar, I believed that children could structure their own learning, and I had amassed a wealth of concrete details to help them do it.

I no longer wanted to be a teacher who occupied the center of the classroom, making all the important decisions, but one who was supportive of children's initiative and encouraged children's activities even though they did not always fit my idea of what children *should* be doing. Having the model of other teachers in the seminar, many of whom had abandoned the traditional center-of-the-stage method of teaching, gave me the confidence to go out on a limb without undue concern that it would break. These changes, among others, represented a huge jump from my understanding of the informal classroom as a place where tables replaced desks.

During the course of the seminar, I had become a junior college instructor in a department of early childhood and had incorporated much from the seminar into my teaching (teaching adults has a lot in common with teaching children), but mostly I was squirreling ideas away for the future. When I reluctantly left the seminar for California, feeling newly professional, I was eager to try my philosophy in a classroom. Though I eventually conceived and implemented a program which had its roots in the discussion and issues raised over those two years, that was still one job away.

3

The Behaviorists

During my second year in the seminar, I supervised a student teacher who was teaching in a day care center. Up to then I had thought that the educational options available ranged from a Shady Hill informal classroom to a Shady Hill eighth grade (famous for its traditional teaching of the Civil War). I could not make sense of what I was seeing in this new situation, and my perplexity runs through the Commentary. This is an obviously confused incident I presented to the seminar:

> There are 15 children in this class; 12 are black, three are non-English speaking. They are three years old. Their mornings are spent fully structured down to the minutest detail. How they perform each activity is carefully monitored. The children are under strict control, but they are not about to burst out. They needed and received instructions for everything--even what to build in the block corner. (The day I was there they built garages for cars.) When my student allows for play situations as we know "free play" in nursery school, the children never get involved and are very lackadaisical and wander away. Unstructured free art projects result in the same behavior.
>
> What these children are getting is experiences in following directions, experience in listening to the teacher talk, and experience in having a longer and longer attention span imposed on them for teacher-selected projects. Do they ever have a chance to do what they want? I tell my students to listen to children for cues about what to do--but these children don't talk. Is it because the teacher is always talking? Always telling them what to do in what order? They never have a chance to do anything for themselves in their own way. How come they don't burst out of control? I would.

The teacher of this class was dedicated, and clearly felt she was serving the best interests of the children. She had a list of goals which she distributed to parents and student teachers. But I had never seen anyone teach that way and I was beside myself with frustration--my own and my student teacher's. This carefully planned,

carefully monitored classroom had nothing in common with anything in my experience.

Had I recognized that this was a classroom based on entirely different premises of how children learn (behaviorist ones), I might have been able to make sense out of what I was seeing. I also might not have accepted my first job in a California school which prided itself on its exemplary behaviorist teaching methods.

FACING THE DIFFERENCES

I hated that job. I thought I was to be a "transient teacher", someone experienced who comes for one year to share as well as learn. But it was very clear from the beginning that this was not to be a two-way experience. Since most people came knowingly and willingly to learn these behaviorist methods, I was an unwelcome gadfly.

All the global issues of my past were suddenly irrelevant. The type of question this faculty debated was: "Is massed practice of a skill better than intermittent practice?" I struggled with almost everything in a great wave of overreaction.

Some of what I had always taken for granted was called into question. Children's feelings had always been a legitimate concern of the teachers I knew. We speculated about the inner life of children and often acted on those speculations. Here only observable behvaior counted and that meant a child's inner life was of little consequence. Children were taught to label their feelings, but real genuine attention to individual feelings and what caused them was not a priority in this system. My concern with feelings and my expectation that they were of some importance were taken as signs that I was being overly maternal and not to be taken seriously. The emotional life of the child belonged at home. The principal's advice to parents was "You love them, we'll teach them."

An example of my colleagues' attitude toward feelings, albeit an extreme one, was the case of Chris. Chris, one of the youngest entering children (3.9), was the first to arrive and the last to leave. (She was pointedly told by several different adults that she was too early, but obviously this three-year-old child could not change her circumstances.) No effort was made to make her comfortable during these lonely periods. She sat in the front hall by herself at both ends of the day. I volunteered to read to her and was told that would not be realistic. If her parents could not conform to the rules, the child would have to learn to cope using her own resources. (No dependencies allowed in this school.) Not surprisingly she cried. She cried in the morning, and during school time, and after school.

With my ingrained approach to separation anxiety, I wanted to hold her in my lap and talk to her about what was bothering her. Instead, to control her crying,

she was asked to stay in a small dark room until she stopped. (The reason for darkness was to avoid hurting her eyes which were sensitive from crying.) When she decided to come out, she could open the door of the room which was blocked by a table. The door would move the table and alert the teacher that Chris was ready to receive positive reinforcement for stopping her constant flow of tears. I was surprised at this technique, but I was shocked when her mother, at a conference well into November, admitted that she and her husband had separated the first week of school (shedding light on the problem with scheduling). No teacher had ever asked Chris why she was crying! It might have been because her father left or because she wasn't ready to separate yet or because she found this great big school too bewildering when she had to cope alone at both ends of the day. In any case, she was treated in a manner consistent with goals of the school--only observable behavior matters. Causes do not, and negative behavior (crying or coming at the wrong time) is never reinforced by special attention.

Adult-child relationships were impersonal. Touching a child was discouraged because it bred dependency on the teacher. Initiating a conversation on the playground was frowned upon because it encouraged children to be adult-oriented rather than peer-oriented. Even using a teacher's name was not encouraged. Learning the names of six teaching adults was considered a high-level skill and so we were to be called "teacher". The beginning of a group lesson was signalled by the third-person singular: "All eyes on the teacher."

In time, one could point to children who went about their daily business of school without emotional incident. The children learned quickly enough that this was not a place to look for emotional support. Spontaneity was a negative value; the unexpected was rarely allowed. Doing something on the spur of the moment because it seemed like a good idea or because some external circumstance changed was considered a waste of time. Learning experiences needed to fit into a carefully sequenced pattern. The following incident is typical of both the downplaying of emotions and the controlled environment:

One rainy day, all 60 children in the room were listening to a record and looking at the accompanying storybook pictures. A bird flew into the room through an open door. Very few looked up, so well-trained were they in attending skills. In an attempt to exit, the bird crashed into a glass door and fell to the floor. A few children noticed, but the listening continued. After the record was over, a teacher went to the front and asked if anyone had seen what happened. She them demonstrated how the still-alive bird was to be disposed of--not with bare hands, but with paper towels. The message, like most lessons in this method, was crystal clear--birds carry disease. (There should be no grey issues in presenting

information to children.) The lesson proceeded to a crystal clear explanation of why hands need to be washed before eating and the children were then dismissed, several at a time, to wash their hands before snack. There was no opportunity for children to ask questions. Nor did they assert themselves if they did have a question. Group time is generally a time when teachers talk and children listen, and deviant behavior had long since been extinguished. The sequel to the bird-disposing lesson was not totally random. The precise method of presentation had been planned at a meeting the previous day, but it had been decided not to present a handwashing lesson the day before the weekend because it was thought to be less effective than a beginning-of-the-week lesson which could be immediately reinforced.

What other possibilities were there in that situation? In a different classroom, the incident could have aroused strong feelings about death, accidents, the ability to nurture a living creature back to life, which would have far overshadowed disease and handwashing. But what could any adult do with the aroused emotion of 60 children in one large group? (Had I been in charge, I would have skimmed off the few children sitting in the back who had noticed and taken them outside with the bird and I probably would have forgotten to use paper towels.)

The system was more rigid than any system I had ever been involved in. When it was time to take a group of children to the library, during the first week of school, it would have been very convenient had I been allowed to take the group alone. Although the campus was big and I had never gone the accepted route from our classroom to the library, I suggested that the children who were in the class the previous year could lead the way. But that was vetoed because teachers must always be in control, and admitting to the children I did not know the way to the library was admitting weakness. (It was on that trip that I first ran up against the no-touching rule--I held a child's hand.)

Schedules necessarily ran like clockwork. Aside from the principle of the controlled environment, the reason for this rigidity is still unclear. One result was that all groups of children needed to be on the playground at the same time and engineering the transition periods of 120 young children within a five-minute leeway is quite a feat of coordination.* That meant the length of time a child spent on an activity was never in the child's hands. Once I gave permission for a child to stay inside with me in order to finish a project on which she was working very hard. I was "negatively reinforced" for that accession to a child's individual needs. Attending behavior, considered crucial to information processing, was well defined. A child was not listening unless his eyes were forward, facing the teacher. In one of my first (disastrous) attempts at teaching the group, a child looked at the ceiling throughout the whole lesson. My colleague, whose job it was to criticize my

*Though beliefs about how children learn were consistent with all the latest learning theory, some of the practices of the school were a function of numbers. The rationale for the large classes was the nature of public school reality; this was, after all, a lab school. One stated purpose of the school was to train public school teachers. A teacher in this system can be taught to handle all 60 children in a group situation and to set up the classroom in such a way that two teachers can deal with 60 children choosing among table activities. The children can be trained by these methods for smooth transitions and the playground set up for maximum independence requiring adults only to check on safety.

efforts, pointed out his inattentiveness and some of the techniques I could have used to extinguish it. Three days later the child approached me with evidence that he had heard every word. (Why hadn't I read the story I said I was going to?) But children who listen have their eyes forward.

The lack of emphasis on emotions, the resulting rather cold atmosphere, and some of the rigidities of the system (probably magnified by both sides under the circumstances) disturbed me. But the real differences came over the issue of how children and others learned.

Take the nutrition unit. Someone in the school hierarchy decided that the 3-to-6-year-olds should have a social studies unit on nutrition. It was a good choice, full of interesting possibilities. I began to spin out ideas for cooking and tasting and smelling. I had in mind real food, but no such ideas occurred to my colleagues. The final behavioral objective for this unit (the goal stated so that success could be measured with the naked eye) was: "The child will combine foods to make a balanced meal using foods from each of the four food groups." Teaching children about a balanced diet is admirable. But all by rote? And pictures? With no real food?

In order to be able to reach the final behavioral objective the children needed to identify foods within each food group. But before that, the first skill to be mastered was the naming of foods. I took a survey of all the children to see how many foods they could name, using a set of pictures which were rather like flash cards. The purpose of the survey was to establish baseline data in order to determine how many new food pictures each child could identify six weeks later. Next there were lessons to teach the food groups. The teacher would hold up a picture of an apple and say "Hold up your hand if you agree this is a fruit" or they would pass out the picture and ask children to "Hold up your card if it is a picture of a fruit." (That way the participation of the whole group could be easily monitored with a sweep of the eyes.)

Aside from the lack of activity with real food--a serious drawback to a food unit--the opportunity for cognitive growth was not exploited. Children were not asked to exercise their intelligence by forming their own categories of food (or anything else), an activity which does not depend on real objects. No child was ever asked to "Put the pictures in a pile which you think go together in some way and tell me why you put them there." The children learned only to identify an apple as a fruit and milk as a dairy product. None of the tasks were open-ended enough to engage an active mind in problem-solving.

These criticisms reflect my belief in the value of general cognitive growth over the specific learning which can be measured after teaching. I have to grant that my methods would not necessarily get children to the behavioral objective: "The child will in six weeks

identify foods by their food groups," or "The child will, given a food group, list 10 foods of that group." I must admit that children of this age are highly unlikely to develop the concept of food groups on their own, no matter how much experience they have with real food or piling up pictures. But how important is it to be able to label food pictures or associate foods with food groups? What qualities of intellectual development does that promote? Everything these children learned about food was put into their heads ready-made, and structured from the outside--there was no chance to develop skills other than memory. Unfortunately, there is very little of importance that can be measured shortly after teaching. This constraint severely limits the possibilities for the classroom. The qualities of initiative, curiosity, alertness and intellectual power cannot be exercised in a short daily group lesson. Nor can they be measured as easily as the number of foods a child can identify from pictures.

My activities were not considered worthwhile by the school authorities--they didn't teach anything observable and there was so much useless time spent messing around. I certainly couldn't measure children's development by their rigorous standards and so I had no way to demonstrate the correctness of my beliefs. I left the planning meetings which were devoted to the structuring and sequencing bits of knowledge with a sinking feeling that this is not the way young children learn.

Nor did I learn in such a systematic manner. Just as a child who asked for paste to join two pieces of a cutting project together was told that this was a day for cutting and that pasting would come next week, I was expected to use my observation time on the playground in September even though what I really wanted to do was watch the science teacher. There would be time for that in February, I was told. I felt helpless much of the time, not like a person capable of making learning decisions for myself. I suspected the children felt the same way.

After eight weeks I gave up the job; I had had an intensive experience with a system based on behaviorist principles and direct instructional techniques. The differences between my philosophy and theirs were much clearer to me than if I had done some reading or taken a basic survey-of-education course. I now appreciated this style of teaching and the skill involved in its practice. These teachers were masters in applying learning theory. They were able "to sequence a piece of learning" (learning comes in pieces), dovetail it to fit the children (responses elicited periodically from the children provided that information), move a whole group of children towards the same goal (predetermined by them), and measure the success of their teaching by measuring the children's learning (only observable behavior counts). The goals were defined precisely by the teachers. They decided what body of knowledge to teach, taught it, and evaluated it. Done well, it is awe-inspiring to watch, and if this method were confined to teaching about fire drills and

proper behavior during hurricanes, I think it would be a fine skill to possess.*

*Though it takes time to learn and lots of practice to master, this system enables anyone skilled in it to take a group of children and achieve the same essential results as any other teacher who possesses the same degree of skill. It reduces the gap between the gifted teacher and the mediocre one. Children, they said, have more probability of learning under this method than a system subject to the vagaries of individual teachers' strengths and weaknesses. Perhaps there is some truth in this view, but it does not put much faith in the developmental capacities of teachers.

FINDING A THEORY: PIAGET

It is hard to say exactly when and how Piaget became important to my teaching. Occasionally, seminar members referred to Piaget, and I was intrigued enough to take a course, "The Psychology of Jean Piaget," which examined the Piagetian system for its internal logic, but had nothing to do with teachers or classrooms. I absorbed enough to inspire references in the Commentary: "Kathe, quoting Piaget, says..." Most of my comments were on the order of "That is just what Piaget found!" Certainly, the group was in no way expert in Piagetian theory nor were they unanimous in thinking Piaget might answer some of the questions they were raising. Above all, they were eager not to let theory become a focus of the sessions or get in the way of seeing what was happening in their classrooms.

I had found that using a Piagetian lens to look at children's thinking added another dimension to the classroom data I was collecting. It helped to clarify and draw attention to certain aspects of the way children think, and I began to make connections between Piaget and the examples which were being generated in the seminar. My occasional meshing of theory and specifics, however, rarely became part of the seminar discussion.

But in California, for the first time, I had to go beyond concrete examples and be precise about the theory behind what I already believed; my behaviorist colleagues kept citing "the research" as if all answers were graven in stone. I needed Piaget to reassure me that I had not made up a teaching method off the top of my head as the behaviorists seemed to think. So in my frustration at facing a discordant experience, I read everything I could get my hands on about Piaget and the classroom, and what I read provided a rationale for my teaching. Though this experience with the behaviorists was draining, I had gained the ability to delineate the difference between learning theory and development. I was even more ready to design my own classroom than when I had left the seminar.

4

Environment and Materials

Having rejected the behaviorists, I needed a classroom of my own to try out my newly articulated philosophy. California's educational scene is not monolithic, and I was hired at a private school where the director told me to look around and see what I wanted to teach. It was clear that this would be a perfect opportunity to try my version of the open classroom. I had the rare luxury of total autonomy. On the other hand, I was to be a specialist (subject unspecified) in a departmentalized program and my contact with the children and responsiblity for their total program were more limited than most classroom teachers. I had tremendous freedom to experiment but less time with the children to see the results.

THE SETTING

The school occupies an overcrowded brick building in the center of Los Angeles, which houses a college, a nursery school and an elementary school through the sixth grade. When I joined the faculty I was given a room on the second floor which was used as a curriculum library for the college. It contained shelves--three walls of them extending from floor to ceiling, a sink--the only one on the entire floor, a remnant of the days when there was space for a faculty lounge, and counters--work-height surfaces along three walls. So far it was heavenly, but there were disadvantages. A 10-foot x 12-foot floor space is not very much for active children whose continually growing limbs keep getting in the way of each other. We expanded out into the hall, open-corridor style, with our mess, smells and noise. Since it was clearly the worst working space in the school, no one objected too strongly. The floor was carpeted wall-to-wall. We just learned to live with it dirty and wet. It was cheaper to clean it several times a year than to replace it with linoleum. I rejoiced in the amount of shelving, ignoring the fact that there were no windows, and took pleasure in the sink even though it meant that there was a constant stream of faculty using it when I was teaching. All things considered, having freedom in a room with a sink and so many shelves was a good beginning.

BUILDING UP SUPPLIES

The shelves needed filling. My first task was to send out a letter to the parents asking for their help. I continued this practice whenever my supplies ran low. I scoured the school for cachés of unused supplies and found two years of Science Curriculum Improvement Study (SCIS) science materials which had been ordered long ago and left untouched in a storeroom. Enough for 30 children, this windfall included, among other things, thermometers, magnifying lenses, hundreds of good quality plastic cups, chemicals, pulleys, and a collection of parts which, when assembled, produced 30 machines designed to explore variables.

The rest of the materials were accumulated through a mixture of buying and begging. I had a budget of $20 a month, which was later raised to $50. I spent it at garage sales buying junk--old machines, tools, scraps of any kind, locks, scales and mystery objects. I found a magnet factory where I could buy some superb magnets for almost nothing by pleading poverty and the cause of education. I walked up and down the streets of Los Angeles looking for interesting industrial waste. I found a place to buy cheap batteries and small motors. If a parent mentioned a remodeling job on a house, my reaction was: "Then you must have some scrap wood." When the telephone man came to school to fix the phones, I begged a whole spool of wire which lasted two years. The man who repaired the carpet gave us measuring sticks and a level. I found a place to buy plastic tubing and a hardware store that gave me a discount for nails, light bulbs, and fishing line. I got the kitchen to order food coloring in bulk and was relieved when it went on the juice budget instead of mine. Parents supplied not only the usual milk cartons, cans, and plastic bottles, but also leather scraps, tiles, and carpet remains. I inherited an old saw horse, which became a permanent pendulum support, and a collection of dried beans and peas to be used for measuring. Though it grew in spurts, an assortment of materials soon accumulated. The next job was to arrange it.

ORGANIZING SUPPLIES

How to organize the materials was clearly dictated by the fact that 80 children used the room weekly. Everything had to have a place, clearly labelled, and be easily accessible, without a search. Whether random materials or categorized materials were better for the stimulation of original ideas was a seminar issue which influenced me to think carefully about organization. This was not a simple maintenance task.

The materials had to have some kind of logic so that children could learn the plan and find items they needed independently of me. Items had to be similarly grouped

for convenience (woodworking tools and wood, scales and things to use on scale weights), but also placed imaginatively enough so that children saw connections that were not always obvious (batteries, wires, big nails and magnets; marbles and tubes). Non-messy activities needed to be portable so children could remove this equipment to less congested areas outside the classroom. Once the basic arrangement was established, it did not change.

Providing a junk pile so children could generate alternatives in solving problems was a seminar-inspired idea. There were several boxes labelled junk, and sometimes when the supplies were high the boxes became plastic junk, metal junk, and junk junk. One of my measures of growth in a child is her ingenuity in adapting what is available to a preconceived plan. The junk pile promoted this goal. Also the reverse occurred. In the junk, a child could find an interesting object which sparked a project.

Many of the work areas were makeshift. The space for woodworking consisted of a slab of butcher block on which to drill, a blanket to muffle the hammering noises and a lot of counter clamps to facilitate sawing. Water-related activities took place in pots and pans on the floor (the sink was too high for most children). Sometimes there was enough interest to set up the old metal water table (salvaged from the nursery school) which took up a third of the working space.

One wall of shelves was used to store unfinished projects. Each group of children had its own shelf. The amount of storage space for each child was small and that limited the size of projects. But since the working area was small as well, large-scale projects were just not appropriate.

Basic supplies were kept together--clips, staples, scissors and the like. Probably the most useful detail in the room was suspending the tape on a string from the pencil sharpener. Children came to the tape, the tape did not go with them. Tape always stayed in the same place and we avoided all the "Where is the tape?" whining I have heard in other classrooms where the tape is portable.

5

Setting Initial Expectations

The first problem was what to call my program. In the letter to the parents, I had studiously avoided calling it anything. But "new program" would not do forever. Nor were "Stuff" or "Experimentation" appropriate titles, even though they described what I was doing more accurately than Science. Science calls up all those images of lab coats and bunsen burners and The Scientific Method. I was happy that my room was the farthest thing possible from a science lab, but there were some people who were disappointed to find that the school was not adding a traditional science program. The title of Science eventually stuck, and it was, unfortunately, a misnomer.

TEACHING THE USE OF MATERIALS

The second problem was how to teach the use of the environment. Ironically, my teaching the first two months had much in common with the kind of teaching I had just left. I was the arbiter of standards and there was no choice about compliance. Like behavior during fire drills and hurricanes, the expectations were spelled out completely.

One important distinction the children needed to make was the difference between expendables and nonexpendables. The boxes containing expendables were labelled with green tape, the permanent equipment was labelled with blue and red tape. The children could use as much of the green labelled materials as they wanted and could bring the final products home. They didn't need to ask, and I didn't question the wisdom of their use. Most of these materials were donated by parents and were easily replenished by sending out another letter. What was especially satisfying to me was not having to apportion the materials. When they were gone, that was that. The contents of all the other shelves in the room were not to be incorporated into projects to be brought home. These shelves were open to the children with two exceptions--chemicals and glass equipment, and anything on the shelves could be used without permission as long as it went back on the shelves. Those things included not only the tools and traditional science apparatus, but also some interesting but scarcer and more expensive items from my budget like

big nails, bobbins, corks, and marbles. To get my permission to use these coveted items for a project to be taken home, there had to be a plan which I had approved. That rule prevented children from using 10-cent nails for decoration as well as other typical excesses.

Most children came to see the distinction between milk cartons and batteries, if not because the labels were color-coded, then because I counteracted their misunderstandings by fiat. If it didn't have a green label, it didn't go home despite their claims that they would bring it back, pay for it, or steal it. Until this piece of learning was mastered either by rote or understanding, they could not function freely in the room. However, after the rule was established, I occasionally let a child who had worked long and hard on a lighthouse take home the finished product complete with battery and bulb. The other children understood.

I will never forget someone in the seminar saying, "Everytime you need to tell a child where the scissors are, it adds up, and 10 minutes a day helping children find the scissors cuts into valuable teaching time." I trained the children not to ask me where the things were. If they weren't in their proper place then I probably didn't know any more about where the missing item was than they did. It was up to them to search and to remember their annoyance when they were tempted to misplace something at clean-up time. In this respect, the environment was very structured and very controlled. Therewere no grey areas about where things belonged. The labels were clear and every item had a place.

I did not appeal to childrens' pride in keeping their own environment well-maintained. It was not their own environment--each group had to share with four other groups. I chose an authoritarian rather than a democratic technique because it seemed most efficient. Were I running a self-contained rather than a departmentalized classroom, my strategies would have been different.

In the beginning, I sometimes felt as if the content of my program was clean-up and my teaching methods were just like those I had criticized. I consistently rewarded good clean-up and punished sloppiness over and above almost any other activity. I had faith that without proper putting-away procedures, there would never be a real program. Establishing an orderly environment would ultimately insure that the children had much more freedom to pursue their own explorations than if the main activity through the year was finding what you needed amidst a shambles of "stuff".

Interestingly enough, the only items I had to remove from sight because of misuse were balloons. I carried a few in my pocket and dispensed them to those who had thought through uses for them. Other than that the children used the environment well. Light bulbs got stepped on more frequently than I would have liked, but I can't fault the children; since the space was so crowded, it was bound to happen. There were no major pieces of

equipment lost, not even scale weights. The faculty misused the room more than the children, and tools were often missing only to be found borrowed by another teacher.

INTRODUCING ACTIVITIES AND METHODS OF WORKING

When I began it was mid-November and I needed an instant program. All the glorious materials which were eventually collected were still a fantasy those first weeks. After I sent the letter to the parents, I bought four bottles of Joy dishwashing soap and for the next three weeks we blew bubbles. The children loved it, and as the bubbles got bigger and more complex, I began constructing a program.

If I wanted the children to be able to set up themselves, I needed to provide a role model. The first day of class I made the bubble solution (1 cup Joy to 1 gallon water; alternatively, a more expensive but reusable solution is 1 cup Joy and 1 cup glycerine to a quart of water). I set up the cafeteria trays with the solution in each tray, tied strings and straws together, and put out tin cans with both ends removed. Then I turned the children loose with no further introduction.

The second day I put out the Joy, a recipe for the solution, a carton of raw materials, and they did the setting up. After three weeks of bubbles, every child knew how to do a bubbles set up and also got the message that children were expected to set up. As I added more materials, I introduced them in the same manner. When I put out batteries and bulbs the first time, each wire, bulb and battery was in a separate paper bag and every child had a kit. As the children became familiar with what they could do with the contents of their bags, I put the equipment in a container labelled *electricity* and added a large variety of wires, bulbs and batteries. When I introduced sand, I set out cans with holes already punched to make timers, stopwatches, and several assembled sand pendulums with black construction paper underneath. After several days, I put all that material away in labelled containers and any child who wanted to do sand pendulums or timers could set up his own.

The more materials I put into the room, the more complex the choices became. The children were forced to make a choice and draw from their previous experience in setting up what they wanted to do. Since not every child knew how to set up every activity, this method provided an opportunity for children who know how to set up a particular activity to teach others who didn't.

In good behaviorist style, I rewarded those children who "discovered" or "invented" something. I wanted children to observe phenomena without reference to "What is supposed to happen?" In those first weeks, I exuded enthusiasm and showered attention on any child who shared something--an observation, a new use of equipment, or a

new insight. I got very excited when children brought in things to work on--an old alarm clock, some mercury, or an old television tube. Exclaiming over the size of 80 children's bubbles was exhausting, but it paid off. In some cases it paid off too well. I didn't realize how much I was patterning their responses until a child who had a desperate need for attention gave me a glimpse of myself in caricature trying to get children to discover. He would screech across the room, "Look what I found out!" and I would rush over to him only to find him groping frantically for something to tell me. Later, I had to retrain certain groups of children to screech for their peers instead of for me because I couldn't be everywhere at once to share in their now frequent excitement about new phenomena.

At first, I accompanied each of these introductions with task cards or at least cards posing questions. What is the biggest bubble you can blow? Add food coloring to the bubble solution. How does it change the bubble? Can you blow a bubble inside of a bubble? I did this out of habit, a vestige of the assignment system, but my bias in favor of children asking their own questions and pursuing their own explorations must have been obvious. I don't remember ever exclaiming over someone completing a task or getting an idea from a card. The cards were almost totally ignored; finally I stopped using them entirely.

By the time these initial expectations were instilled and I had a rich store of materials, my program was fully developed and tightly structured.

6

Structure of the Class Period

Beginning

The children came in mixed-aged groups (from 6 to 9 and 9 to 11) of 17 and sat down in another classroom adjacent to the working area. I used this time to introduce new materials--a box of leather scraps or a balance scale, or to remind the group that magnets were not to be shaken, or to show them a motor built in another class, or maybe to open up a new possibility by joining two previously unlinked pieces of equipment like tubes which had always been by the sink and marbles which had been next to the scale. Occasionally I provoked a discussion, but not very often because they were impatient to get to work. And they saw this as a time for announcements and not a meeting.

Then, one by one, I asked them what they were going to do that day. If they did not know exactly what they wanted to do, at least they had a general idea like magnets, woodworking or syphoning. Some had continuing projects which took several weeks to complete. I had very few children who ended the year not coming to class with some idea of what they wanted to do. There was a group of three boys, competitive and cliquish, who spent the first 10 minutes of every period trying to reach a joint decision. They had a hard time with the openness of a program which had no clear standards for winning. Another child always said she was going to make a boat and never did. She needed the security of naming something, but her commitment did not last for more than a few minutes. Sometimes a child would say he needed to look around the room for an inspiration, but that was often an indication he was tired or temporarily upset and needed help with a choice.

The dilemma of whether to begin class with a group situation or not was resolved by the fact that 17 children trying to start all at once in a small space was too much chaos. When the children left the group one by one, as they announced their work, the crush was not so violent. It gave me a chance to talk longer to those children who wanted to talk about their project before they started, or just to talk to a child about what happened on the playground or at the Science Museum that weekend.

There was a more important by-product of this way of

beginning the period. This structure gave the children a chance to be totally independent. They could set themselves up without a teacher. The environment was the same everyday, and they knew where everything was. They could set up their own sterno, make their own bubble solution, get out their own batteries and bulbs, and start their own woodworking projects. The California version of the open classroom is one where the teacher provides "learning centers." It always reminds me of a restaurant where the child learns to ask "What's for lunch today, [illegible]ch?" I prefer a "clean counter" approach. In my [illegible]s the children could cook their own meal from start to finish. Encouraging the children to set up without me in the room demonstrated my trust in them and increased their feelings of independence and confidence in themselves. Since I was not present for the initial round of questions, the children were forced to rely on themselves or a peer to get started. My first priority when I joined the group was to help those children beginning a new project, perhaps one I had just talked about. Then I checked the children who were continuing work from the previous week. The rest of the period I spent with individuals or small groups.

Middle

What children did during the period encompassed a wide range of activities. Popular choices were anything to do with water--floating, squirting, timing, dripping. They lit bulbs, built motors, took apart old machines, played with magnets, rigged up pulleys, mixed colored solutions, and did all kinds of construction and woodworking. For those who, at times, needed more structure, there were attribute blocks, mirror cards, and math manipulatives.

This was the only place in the school where the children had free access to a variety of materials and the choice of how to use them. At Halloween some children made props for their costumes and at Christmas they made gifts. One child spent weeks making a cat scratcher out of carpet and wood; another did a careful clay sculpture entitled "Playground", which consisted mostly of parking lots, betraying its Los Angeles provenance; another made a tripod for his camera, and a group of children made relief maps stimulated by a geography unit in their social studies class.

Projects cut across all subject areas. An underlying premise of the program was that no matter whether children were seriating solutions of green food coloring in order of color intensity, or building a boat, or making a puppet, or a jewelry box, they were solving problems and testing the power of their own ideas.

Ending

Ten minutes before the hour was over, it was clean-up time. We started the year with charts and specific jobs, but soon were able to clean up without them. As

the clean-up jobs were finished, the children congregated outside the room again. It was not a meeting but a place to be out of the way of those who were still cleaning up. The children had already shared their work with me and their peers, and they were ready for PE and not a group discussion. Had I felt it was a good time for a meeting I could have set that expectation, but it didn't seem worth it. What they needed most in their day was a chance to work on non-teacher-structured, self-paced activities. Any time away from that was an infringement, so I sacrificed what might (only might) have been good discussion in order to give them more work time.

FREEDOM WITHIN CONSTRAINTS

In many ways the model for this format came from a seminar member's dance class. The children who danced came, took off their shoes silently, danced around the previously built structure (grey square and rectangular wood boxes), had a break in the middle of the period with some direction or redirection, danced some more, and at a given signal put on their shoes and silently danced out of the room. They had an expectation, and it was freeing. Similarly, the children in my class came with an idea, worked at their own pace, cleaned up and left. What happened within those limits varied tremendously, but they could count on my not giving assignments and not changing the environment from day to day.

There was time for experimenting and flexibility about content, but the structure was predictable. Not only was the dance class a prototype, but the format of the seminar with its adherence to concrete examples and prohibition against generalizing provided a similar model. The concept of freedom within constraints was one of the valuable ideas I took from the seminar.

Even the freedom to choose the subject of their curriculum was a constraint. The most important expectation I had was that children come to class with their own ideas of what to do. This was so ingrained in them that after two years of working with me I had a terrible time making any temporary changes. Once I had an especially large group because a teacher was absent. It had rained in LA, a real novelty. There were actually clouds in the sky instead of solid blue or solid smog. I set out blue and white tempera powder and attempted to motivate the group to look at the sky and translate it into into a painting, finger painting, easel painting, any kind of painting. Even though the sky was beautiful, their expectations of doing their own work were so strong, and there was so much resistance, that I opened up the options to include anything to do with the sky. Immediately, they connected with their previous projects; airplanes were obvious, but boats became hydroplanes and syphoning became rain-related. Out of the work of all 25 children,* there was only one finger painting.

*That these same children were eager the rest of the day for workbooks and teacher instruction is a tribute to the fact that children are eminently adjustable. Their expectation in my class was that they would have time for "their work", and when I tried to give them "my work" on "their time" (a seminar distinction), they resisted heartily. But they were happy to comply with the different expectations of other teachers. When a change was absolutely necessary I had to send the message loud and clear, "No choice and no discussion." Had I wanted to alter the format of the class, it would have required a major retraining.

GROUP COHESION

When all the children are not involved in the same content, how is group spirit generated? How are the needs of the group balanced against the emphasis on the individual? One device to unify the group is to have them share what they have done at the end of the period. I sacrificed this option to gain more working time. But despite the fact that discussion never involved the whole class and the projects were done individually or in small groups, there did develop a group feeling. The room was so small that cohesiveness came just by proximity. In fact, sometimes the feeling was even claustrophobic. The sharing with those nearby and the excitement of discovery which ran through the class was conducive to good group spirit.

Even so, somtimes I felt (imagined?) a need for a larger project where everyone works together. Once I initiated the construction of a gingerbread house. It was to be done from scratch, including measuring the templates accurately enough so that the house would not collapse. The children enjoyed cooking and icing and decorating, but all the hopes of giving them experience in measuring and dealing with spatial volume did not materialize. The force of a child's interest to resolve the problems of a teacher-initiated project is not nearly so strong as it is to resolve a self-chosen problem. Often as not, the teacher ends up dealing with the difficulties so the predetermined product will be on schedule, which is what happened. The children most likely remember the trip to deliver the gorgeous gingerbread house to a children's hospital and all the oohing and aahing over its beauty more than any measuring or constructing.

Better by far were the child-initiated cooking projects. This started as a dare from children who had not been involved in the gingerbread house--"Why don't you let *us* cook?" I gave them permission to cook anything they wanted as long as they did the planning and brought in the ingredients, recipes, and any equipment they needed. Social goals were fulfilled with phone calls outside of school, new friendships and a renewed spirit which included friendly competition as to which group could bake the best chocolate cake or French bread (their two consistent choices). More important, the children were dealing with problems of their own making. Someone forgot the baking powder. What could substitute? There aren't enough eggs. What will happen if we split the cake in two and don't use eggs in half the recipe? We don't have the right pan. What alternatives are there? Why did this bread crust turn browner than mine? The chemistry of cooking is endlessly fascinating and much more intellectually intriguing when the idea is a child's.

In choosing for themselves, children may satisfy needs which teachers overlook. In this case, the constant repetition of the same processes gave them much more insight into what they were doing than if they made something different each time.

7

The Teaching Interaction

In the second session of the seminar, someone had said something to the effect that 90 percent of a teacher's skill is in making decisions when interacting with an individual child. The teaching interactions were the core of my program, and they took on importance they did because of the care and precision with which we had discussed them in the seminar.

Ascertaining what aspect of a situation the child is focusing on, stimulating careful observation, asking for predictions and alternative solutions, and provoking thinking about variables constituted my curriculum. There were no task cards or previously set-up activities. The caliber of the classroom was dependent on the quality of the teaching interactions.

As I moved around talking with children individually, these are some of the things I did:

I listened

I often began by asking an open-ended question like "What is happening?" or "What do you see?" and then I waited. This keeping my mouth shut was a radical change for me. It was a big jump from a teacher who knew about Greece and was going to tell all about it to a teacher who listened carefully.

A consistent and conscious effort to see the child's point of view is basic to implementing this method of teaching. The beauty of the open-ended question is that the child clues me in on his immediate interest. For instance, I saw a child trying to make clay boats and failing. One assumption is he needs help in shaping the clay (after all, the point of the clay boats curriculum is to make clay float), but my open-ended question produced the answer, "I am trying to see which boats sink." And it follows that if you are listening to children, you can't bombard them with teacher talk. Teacher talk may have some place in the school day, but it doesn't help to produce problem-solvers or independent thinkers. It does help propel children toward "the fatal facility for language" (the marvelous phrase I remember from the seminar), which sounds so impressive and often represents little understanding.

When a substitute had my class for a week and "taught" them all sorts of explanations for the classic experiment of extinguishing a flame by putting a jar over

a candle, it took me days to get a group of boys to go back to looking carefully at what was in front of them. They talked about hypotheses (not guesses) and heavy oxygen (sic) and hydrogen molecules. It was clear they liked the sound of the words, but their interest never went beyond repeating the phrases too often.

A child who had a complicated but unclear idea in mind had to clarify his own thinking in the process of talking to me about his or her project. I had no hesitation in admitting that I didn't understand and would he or she please explain it again. This was not unlike a seminar member's attempt to get his fifth graders to explain fractions to a confused adult, only I didn't have to make it a game as he did. It was perfectly logical to explain to me what you were doing, since it was your idea in the first place and not mine.

In listening to a child talk about his construction, I am torn between using this time to value what he or she has created and leave it at that or to probe and ask specific questions that assume the product is meant to be a functioning copy of reality. Some six-year old girls made a fleet of very elaborate boats with all the amenities for comfortable living, but the hulls were cardboard. I was the only one concerned about floating. Had they named their construction houses, I would have been satisfied. I was bothered not only by the illogic of their non-floating boat, but by the incompatibility of my concern with a child-centered focus. Occasionally some good ideas get sparked, and a child sees new possibilities with that kind of questioning. At other times, I get that look of "I like what I'm doing, but if you think I have to have reasons, I'll find some to give you."

Another purpose in listening is to encourage peer discussions without talk from me. Because I am absolutely committed to not using my authority as a teacher to convince a child of something he is not yet sure about, I depend upon peer discussion to resolve a child's logical inconsistencies. For a group of children struggling with a puzzling intellectual problem, their learning will be more secure if they argue amongst themselves rather than be guided by me through a series of questions and answers. If the problem is engaging enough, the discussants will argue the issues until they reach some conclusions which satisfy their own internal logic or at least raise points for further thought.

I had a fantastic group of about four or five boys who for several weeks set themselves up around buckets of water and discussed why things floated, how much cargo their clay boats could carry, what shapes were best, and other related questions. They were gripped--they could not reconcile that steel tankers float but heavy things sink--and discussed it among themselves for days on end. I encouraged the discussion by my interest in listening. I added materials such as a waterlogged piece of wood the same size as a dry piece, some Ivory soap and some other soap the same size, and I substituted a glass fishbowl for the aluminum pot, so that the water level could be more

easily observed. But I resisted the temptation to "teach" them the rules of flotation. I have no doubt that waiting patiently for them to come to their own understanding will produce more secure knowledge than if I had provided them with words that sounded impressive and convinced others of their learning, but were of no use to the development of their thinking.

Peer pressure is potent, but it is much less potent in the child's view of learning than the "teacher knows everything" image. The child is more likely to adopt his friend's hair style than he is to agree with his friend's opinion that the rate of a pendulum is unrelated to the weight of the bob when he doesn't really believe it.

I Focused on Problem-Solving

The definition of problem-solving can be argued by the cognitive psychologists endlessly. Without trying to be all-inclusive, I consciously emphasized several specific aspects of problem-solving which lent themselves to my program.

When a child came to me with a request for something he or she needed for a project, my first response was to ask the child to clarify the function of what was needed. When a child needed something to make posts for her canopy bed, she needed to tell me what the posts were for, how much weight they needed to support, and to consider how they could be attached to the already-made bed. The point of the interaction was to clarify her ideas and then to encourage her to spin off as many possibilities as she could even if not all of them were plausible. In this case, the child rejected the things on the long, thin shelf and the junk boxes and finally remembered that she had some chopsticks at home which would be perfect. She would attach them with blue electrical tape which matched the fabric of the canopy. I didn't provide the solution, but our discussion set the pattern of searching for alternatives. In time, the children learned to consider options without consulting me.

Another type of problem-solving skill is the ability to make predictions. Making predictions based on past experience is important, but I felt it also important to learn to feel comfortable with risking a guess. I wanted children to be less concerned with the Right Answer and more interested in the world as a place full of fascinating phenomena on which they can express an opinion without penalty if they are wrong. In a properly supportive environment wrong answers may be valued as clues to thinking. This will increase children's eagerness to meet new situations with confidence; they will not be penalized for a bad guess. A particular shy and whiny child refused at the beginning of the year to try anything new, much less venture a guess. In addition, she had a real inability to think ahead in a construction project. Constant practice in making predictions increased her willingness to try new projects, and also enabled her to plan ahead. At the end of the year she was comfortable making a stab at something, trying it out, and not being

bothered if her answer was wildly wrong. She added plaster of Paris to a salt solution in hopes it would grow a crystal. She just tried again.

A child playing with an inclined plane or a pendulum is much more likely to pay careful attention to the variables involved, if he is in the habit of making predictions and will be less likely to mindlessly manipulate the materials. A willingness to make predictions is a spur to deeper involvement with materials.

My response to a prediction is "Try it," and that means shifting the focus to variables. I agree with Piaget that children are not able to manipulate and coordinate all the variables in a situation until they are formal operators. The youngest children had only the most fleeting glimmer of the need to vary one aspect of a situation at a time. The oldest had a better grasp, but their abilities broke down very quickly, if their problem was complex. Still I believe that experience in being asked to consider variables will produce a more securely rooted ability to deal with variables, as development proceeds towards formal operations.

The following kind of example recurred over and over:

Me: What is happening there?

Child: It's bubbling! (with surprise)

Me: What do you think made it bubble?

Child: The baking soda.

Me: If you put baking soda in a cup by itself, will it bubble?

Child: No. I added water.

Me: Baking soda and water bubbles?

Child: Yes.

Me: Try it. (he does)

Child: Well, no.

Me: What other things did you add to your mixture?

Child: (reading from his list) Vinegar, salt, and flour.

Me: What do you suppose produced the bubbles?

Child: I don't know.

Me: How could you find out?

Child: Put one thing in at a time with the baking soda.

Me: Try it.

Child: OK, I will.

I come back in five minutes, and the child is still mixing lots of things together.

It wasn't that the child was uninvolved with the problem. It was that he saw only for a transitory moment the need to try one thing at a time. I had the feeling that some children regarded this task of trying one thing at a time as some sort of strange and ridiculous adult endeavor. As long as I did not expect the children to immediately leave my presence and go off and perform rigorous experiments of their own, I believe the discussions of variables were valid. Sooner or later, as children develop, the transitory understandings will be more prolonged and their logic will become more adult-like. I did not try to simplify their experiments by putting out only vinegar and baking soda, since my goal was not to leave them with an over-learned fact that vinegar and baking soda bubbles, but to leave them with the conviction that mixing things yields interesting reactions. If they have enough experience mixing things, there are some patterns that will emerge in time. By then, the pattern of asking, "What one thing do I need to vary?" will be a part of their thinking.

To satisfy my adult needs for experiments with isolated variables, I occasionally set up experiments with big signs: VINEGAR AND BAKING SODA. IT BUBBLES. How much children learned from these demonstrations, I can't say. By the end of the year children knew about vinegar and baking soda. They knew it because I introduced test tubes and balloons, and they knew exactly what ingredients they needed to blow up the balloon. But it was because they did it themselves and not because they read it off a sign.

The need to control variables permeated almost every activity: "Your light bulb didn't light? What do you think is the matter?" "Some clay boats float, some don't. What is the difference?" "Your motor is turning slowly. How can you make it go faster?" "Your sand clock measures 20 seconds. What do you need to vary for a clock measuring 10 seconds?" "How can you dissolve the most salt in a cup of water? Try it two ways and compare."

There were a few children who could control for one variable at a time throughout an entire task. One child spontaneously decided to seriate a collection of 20 cheap bar magnets. Without any help from me he attached paper clips to each magnet end-to-end, counted the number each magnet held, and put each magnet with its paper clips in separate labelled envelopes in order of increasing strength. Others could execute this kind of activity if I structured it for them, but they relapsed when left on their own.

For that reason I did not insist on "proper"

experiments with isolated variables. Until a child can set up his own "proper" experiments according to a logic which he himself understands, there is no point setting up experiments for him. Such experiments imply an exercise with a preconceived end and will only undermine his confidence in his ability to find out for himself and probably lessen his interest in the problem. (The distinction between child-initiated experiments and teacher-prepared ones reminds me of the distinction between the elaborate projects a seminar member says she used to do with children which they never repeated on their own. She felt these were more a tribute to her own ingenuity and creativity than anything the child gained.) I could have taught and required accepted experimental procedures, but it would not have served my goals for the children.

One thing I did not do was to teach by analogy. For instance, in trying to differentiate two 1½ volt batteries of different sizes, a colleague explained it was like having a larger gas tank in the car. He had lots of those kinds of images. They always intrigued me because they did clarify ideas--for me. I steered away from them, however, because I think the language can be a hindrance, and the child may focus on a misleading aspect of a situation which would have never occurred to an adult.

On the other hand, what is the difference between using Dienes blocks to represent a system and using the analogy of the larger gas tank to represent a larger 1½ volt battery? The Dienes system is internally consistent, whereas the image of the gas tank introduces a distraction. Someone in the seminar once said that "thinking is facilitated by letting something stand for something else." Maybe that kind of analogy does result in more flexible thinking, but there is always that "fatal facility for language," and the danger is that the analogous thinking will give children words and images for things they have not completely understood. It is better to let children describe their world in words that they choose.

For the same reason, I try not to engage in "why" discussions. "Why does the light bulb light? is so tenuous unless the answer is "I touched the battery to the tip of the bulb and the wire to the base of the bulb and the other end of the wire to the other end of the battery." All the vague generalizations about why electricity works probably present the same pitfalls as a group of teachers discussing how children learn without specific examples. (My seminar-induced distrust of unsupported generalization, again.) Whether children eventually arrive at "correct" explanations after my program, I can't say. But a seminar example about the physicists who couldn't deal with an actual balance, only with theoretical ones, is proof that proper explanations do not always mean total understanding. Whether my teaching hinders or speeds up the eventual ability to understand causes, I don't know. What I am most interested in for this age group is that children have

their own ideas, look carefully, and devise ways of testing out what they think.

I Supported

The model of the teacher as supporter rather than judge came from a seminar member's descriptions of drama in her classroom. It was easy to support discoveries, especially the kind Elementary Science Study guidebooks tell you will happen. It was harder to support activities that looked unproductive to the casual observer. But those seminar examples allowed me to stand up to the more conventional image of the teacher as arbiter of the value of a child's interests. For instance, the fantasy play with magnets went on longer than I'd hoped with a particular group of children. Our magnet collection consisted of three exceedingly powerful Alnico horseshoe magnets I had begged at low cost from a magnet factory plus about 40 other variously shaped magnets of industrial quality. The children were very satisfied to move them around with toy cars and other props brought from home. The structures they built with these magnets were elaborate; they built more and more complex structures with more and more imaginative stories without concerning themselves with questions of magnetic forces. But when discussion of magnets happened to come up, those children who played the longest with the magnets had a superb sense of their behavior; they knew instinctively where the poles were on doughnut-shaped magnets, the relative strengths of various shapes, the amount of work each magnet could do. Their eyes lit up when the subject of magnets arose. The interest and intense messing around which surrounded these magnets made the superficiality of the experiments in the books accompanying the usual weak school magnets very apparent. Supporting the children's fantasy play stimulated more learning about magnets than would have occurred had I diverted them to more traditional magnet experiments.

Another kind of support involves a child whose activities seem inappropriate but serve an unmet developmental need. In an open classroom, needs often surface that are labeled regressive and prohibited in a different kind of classroom. Supporting an immature child is not easy, but can yield results. One such child who had a low self-image and gave everybody trouble made real progress in my class. He was barely in control when he mixed stuff together and the mess was incredible, but I allowed it. Miraculously, one of his mixtures grew the most extraordinary crystal formations, and the next day with more mess and more sloshing he was able to repeat the solution which produced the beautiful formation. No one else could duplicate his crystals (I finally decided it was the unique debris on his hands which gave his crystals something to form on), and they became, to all 80 children in the program, "Mark's fantastic crystals." His attitude toward himself began to change and he asked me all the time, "How come I'm such a good crystal grower?"

We began to use his crystals to seed other solutions. He was an expert. He had a reading problem, a short attention span, and a propensity to hit, but as he became "a good crystal grower" his behavior improved. Whether the crystals were responsible or not, I can only guess. I think they were.*

Another area which calls for support because it contradicts some of the truisms about developing good work habits is the "have you finished what you started?" issue. I have always been interested in persistence, and my first example presented to the seminar dealt with that issue. More experience has sensitized me to the student who turns off because I made a wrong step or he just isn't ready to focus because of hunger, fatigue, or some similar reason. I place a high value on persistence in solving a problem and not giving up because a technical obstacle presents itself. But I have ceased to value the finishing of a product as an end in itself. In this I have been influenced by the seminar. The many seminar examples of children who leave a project for a time and then return to it later with *the* solution encouraged me to abandon the expectation that every project be finished before another one is started.

In order to harvest more fertile ideas, I supported whatever problem-solving occurred on the project of interest at the moment rather than require a dead interest to be prolonged to dutiful completion. As long as children did not tie up valuable (in money and scarcity) materials and leave them forgotten, I did not interfere. Some things were forgotten; a one- or two-hour-a-week program has that built-in hazard. But I was amazed at the number of children who kept their projects in mind from week to week.

Another related issue casually associated with judgment rather than support is "How does it look?" A seminar comment, "I have trouble judging quality by just looking at what they have finished. Do all the children's things need to look finished, so *we* can be proud," influenced me towards support rather than judgment. The actual product reflects so little about the quality of the thought, especially when the technique is still growing. The problems solved may be complex and the solution original, but whether the products look good may depend on knowing how to tape properly. Often the row of children's stored work did not look very impressive. To an untrained eye, it sometimes looked like nothing more than a bunch of milk cartons. I persisted in my support of these dubious-to-the-observer products and rejoiced in an opportunity to make my point when the same kind of product was made by a teacher at a faculty workshop. She made three magnificent-sounding instruments out of cans and odds and ends I had around. They were sturdy enough to use for music with the children, and they sounded good; they had all the attributes of a successful project. But they looked sloppy.

The line between support and setting limits is fine.

*I saw Mark recently--two years after his fantastic crystal growing. He barely said hello as he launched into a description of his latest crystal--a salt solution which he managed to evaporate so that a roof formed over the container.

I didn't always draw it well. A group of older boys constantly tested me to see if I would support bombs and large fires. They did this mainly to annoy me and usually succeeded. I had to limit a spate of gun-making because the guns were interfering with outside play. I reluctantly limited the heating of sugar sculpture. I was too conflicted about the amount of sugar being consumed by children whose parents probably went out of their way to set limits for them. There was a lot more to be learned about the behavior of sugar at various temperatures, but I had no graceful way of controlling the consumption of the product.

There were a few children who proposed to operate entirely out of the range of possible activities. The same group of 11-year-old boys who wanted dramatic results from their work often wanted the freedom to socialize. The issues that concerned them were indeed more important than the work they proposed for themselves. I wished for the courage to let them have that freedom to use class time as a bull session, but I didn't have it. And they often took the freedom without my support. The hassles we got into were not productive, and I failed to get those particular children consistently involved in my program. Had I had the seminar for support and ideas, I might have had a better chance of success with that group.

Excepting that group of children, all the other children received my support for their activities, even when my old teaching self sent a message to my head, "What could they possibly learn from that?" The question, however, is a valid one, and no analysis of a program can avoid an attempt to answer it.

8

Evaluation

Having developed this program from my experiences in the seminar, I looked back to the seminar for support in evaluating it. Invention (trying out ideas without preconceived results), the spirit of playing around without regard for right and wrong answers, picking up skills and ideas from others to incorporate in a personal way, and deep involvement and pleasure in this kind of experimenting were the attitudes I was trying to instill. I developed some straightforward guidelines from observable behavior (some influence from the behaviorists).

I judged that children were involved and that they were having "wonderful ideas," and not just a "wonderful time" (a seminar distinction), if they were talking about what they were doing and not about last night's TV program. If they were having a congenial chit-chat, they were more likely to be just manipulating the materials and not really thinking hard or devising ways to test out ideas. I noted who in the group was prone to vary the conversation, whether it seemed a clue to boredom, an overture to a new friend, or idle chatter. Had the children been in my class all day long this might not have been a good criterion because that kind of involvement can't be sustained all day long. But, for one or two hours a week, it was generally a good guide to how much they were concentrating.

Another guideline was: did children work on the same project for the whole period? I did not insist on task completion or carry over from week to week, but I found that if a child was involved with a particular problem, he or she would stick with it the entire time. I valued staying with one activity and I looked for evidence that children were meeting that goal. But I had some children who worked on several ideas simultaneously. Keeping the examples from the seminar in mind, I did not interfere.

Another indicator of involvement was whether the children came on the optional day. All children were required to come once a week, and there was one day when they could choose between art, recorder, and me. I had a steady group who chose the extra day. Most of these children had been in my program the previous year when they had the option of coming four times a week. By the end of the second year, this group had internalized most of what my program was about. I participated and shared,

but they were a well-matched peer group and provided their own feedback, questions, and stimulation. They seemed ready to approach whatever teaching was offered them in the spirit of playfulness and discovery. They had a willingness to make new connections. My evidence for this was that when offered an unknown material, say a rock or a new salt, they immediately tried out a variety of possibilities. They tested it for conducting electricity or magnetism. They tried to dissolve it. They looked at it under a magnifying glass. They heated it.

The other group came once a week and consisted of those who chose the other options and younger children who had not been in the program at all the previous year. The difference between the two groups was striking. The latter did not ask themselves interesting questions and confidently devise ways to test out their answers as consistenly as did the group that came by choice.

However, the once-a-week group developed independence in finding and using materials. They learned not to ask, "What do I do now?" They developed resources of their own. They stopped asking me about a piece of equipment or a new material: "What is it supposed to do?", and played around with it themselves to find out how it behaved.

For both groups, I can feel pride in what they have achieved. I have raised their tolerance for ambiguity and increased their reliance on themselves for answers. But there comes a time--maybe report time or director's evaluation or just a bad day--when I wish I really knew what they are learning. A quotation in the Commentary addresses this issue exactly: *"What happens to any fleeting understanding that the children may have when there is this kind of flux and lack of continuity? What kind of organization would help children take a second look at phenomena and then a more exhaustive look? When is it appropriate to help children consolidate what they have learned?"*

These questions are the ones which concern me most right now. I have no easy answers. In the spirit of presenting concrete examples to the seminar, I would like to discuss these questions using what happened in my classroom with crystals.

CONCEPTS AND CRYSTALS

It started by accident when a child left her salt solution on a high shelf unnoticed from October to January. When it was discovered, everyone wanted to grow a single salt crystal like the one she had grown. This activity absorbed all my classes from January to June. It was singularly appropriate for a program where children came only once or twice a week and could observe real, often dramatic change, from week to week.

I never "taught" anyone how to grow a crystal. We just tried things in the room: an unlimited amount of

salt, a somewhat more limited amount of sugar, Epsom salts, and other ordinary kitchen powders. We tried different liquids and different temperatures. Resistance to trying one substance at a time produced a lot of hybrids until some child succeeded with one salt, and others followed. There was contagion, and information floated around the classroom. I was wrong about many things: I began by thinking baking soda would never grow a crystal, but we tried it. Eventually little tiny crystals resulted from dissolving and evaporating it. I added more ingredients to the shelves: Boraxo and alum, which grew some super crystals. We tried cobalt chloride. Occasionally, we even measured proportions and followed recommended procedures. Realistically, though, things spilled two weeks after an experiment was begun, or foreign objects got into the solutions, and the crystals still grew. So we didn't make a fetish about precision. We experimented and if results were good, others tried the same experiment. Sometimes they worked, and sometimes they didn't.

There were spin-offs from the basic activity of saturating a solution and letting it evaporate. Children made "crystal gardens" by arranging salts in a pattern and dripping alcohol and food coloring over them. The gardens looked like rock formations the children had seen on a school camping trip to Utah. The parallels between rock formations and salt crystals began to surface, and rock collections appeared at school. An archeologist friend of mine brought in a piece of Calcite he had dug up that very day. *Natural History* featured crystals in their spring issue, and I hung the pictures on the wall. These same spectacular crystals were seen at the Smithsonian by some of the children on a school trip to Washington. Some children heated solutions or melted sugar crystals. Others ran electricity through salt solutions. It all *seemed* connected. But I thought back to the original questions brought up in the seminar: When is it appropriate to help children consolidate their learning? What did children in my class learn with all that randomness?

I knew there was a lot of information about crystals floating around. We were growing a variety of crystals, and more and more children abandoned their gloppy mixtures for an attempt to grow a large, single crystal. Still I had the feeling that very few children were putting it all together. I had a more global knowledge of crystals than any one child. I read, I talked to other people, and I saw the results of 80 children's experiments. Did any one child learn a fraction as much about crystals as I did?

I did several things in an effort to answer this question. I put charts on the board, and let children fill them in. There was mild interest, if that. In June, I had a full-blown discussion with everyone sharing their examples. I felt like my old teaching self. About six out of each group of 17 loved talking about their

crystals to the whole group. But the rest, who had been eager participants all along, sat quietly or not so quietly and waited for the period to end. I devised a crossword puzzle on crystals for their enjoyment and for me to see what they knew. But the effort of doing the puzzle so exhausted them, that I had no indication of what they knew.

Writing books about crystals might have been an option in some circumstances, but they were not fluent enough writers to be able to use such an opportunity without its draining all their energy away from the actual experimenting. For the same reason, reading and work sheets were not the answer, even though the sight of a class reading and then doing a worksheet is very reassuring to an old social studies teacher.

The evidence that their learning was consistent with my goals was ample. It was even easy to write reports on each child. The children were looking at the work in front of them and reasoning from what they saw and not from what "should" have happened. They were willing to consider various possibilities for what produced their results, including "I must have been sloppy." They were willing to try a variety of ideas without regard for "the right way." If a child didn't get a recognizable crystal, he would try again or redirect his attention to some aspect of the result he got. They were willing to take risks. They were confident in their ability to set up materials and proceed on their own. They were excited about their work and eager to share it.

These abilities, which developed over time to some degree in all the children, were apparent to other teachers. All is well and good. No one is against independence and flexibility. But these questions of what concepts and facts they are learning still persist.

Maybe what I have done is all a teacher can do to promote learning. But it is still hard to admit that they are learning, if I have no part in consolidating their learning. Did I miss ways of helping them consolidate concepts and amass factual knowledge? Or did I just miss ways of demonstrating it?

Some children were still confusing evaporation and solution. I'm not sure they understood the concept of a solution, no matter how many times they had put a salt into hot water and stirred. They did know that different salts form differently shaped crystals, and some may have had a real appreciation of the dissolving and evaporation that form crystals in nature. Will they remember our crystal study when they are on a hike and see crystal formations in a mountain stream? When they are making Jello and dissolving the crystal-like powder, will they wonder why it doesn't form crystals when they leave the liquid to evaporate? Or does it? I have no evidence that their knowledge will transfer beyond the classroom or that they will remember anything about crystals when they move on to their next science experience. If they had to pass

a written exam on crystals, I doubt that they could have performed to the level of a directly instructed group.

The temptation to convince the adults in the school community that children are learning in order to assuage these doubts is great, and the interests of children may not be served by doing so. For example, displays can be more useful for adults than children. One early rule about crystals was whatever went into a solution had to be written down. How else would you know a month later what formed that crystal? The writing was treated as a necessary aside, just something you had to do. They wrote on high-quality cards someone donated from an Elementary Science Study mapping unit, and when those ran out they used old cardboard, computer paper, or anything else that was handy. It was a pretty motley "display" of all those random-sized containers and old pieces of paper. I wondered at the time, had the display been neat and pristine, would the quality of what happened been any different? Better or worse? If something spilled, we left it with a sign: "Do not clean up. Salt Solution. Will it grow crystals?"

I got my answer in April, when before the accreditation visit occurred, I organized everything and put questions on cards and made signs pointing to the most interesting aspects. The children never read the signs, and I received their flak: "Hey, you moved my crystal." All the adults commented on how exciting it looked. So as a public relations effort, this kind of organization may be important. But my guess is the children made sense out of what was available, and the adult organization just confounded them.

If my class couldn't pass a written exam--and I have no evidence for their conceptual or factual knowledge, only a belief that children structure their own learning when provided with raw materials, time, and teacher support--where do I turn for help in answering those who say an open program puts too little emphasis on concepts?

I get some support from Elementary Science Study on the issue of teaching concepts. They are reassuring in their view that children don't need formal vocabulary or formal teaching of concepts. They are even condescending about the teachers who "need" to run to the textbooks for explanations of phenomena rather than sharpen their own observations on the material in front of them. On the other hand, SCIS has imbedded in its curriculum "the invention of concepts." In Chapter 2 of the unit on Solutions, the teacher is required to guide the lesson so the child "invents the concept of concentration." If the child is absent, he is out of luck. And I don't know what happens if he doesn't invent the concept properly. I was gratified that in an evaluation of this SCIS unit,* the children operated very confidently with the materials, had a good time, and used careful techniques of keeping records. But their "invented concepts" receded into the background, and they reverted to the most primitive means of testing and forgot their most basic facts. It is

*Karplus and Thier, *A New Look at Elementary Science Curriculum*, Rand McNally, 1967, p. 110-113.

true, the curriculum developers felt the concepts might be taught differently and better in a revised unit, but I am skeptical.

Eleanor Duckworth evaluated the African Science Project* very ingeniously by giving children new and familiar materials and looking at their involvement, originality, and other similar qualities. But even that comfortable kind of evaluation, convincing only to believers, does not shed light on the central question of how you can help the child solidify his understandings. If I were to join the seminar where I left off, this would be a major concern.

*Monograph available as part of this series.

CHILDREN TEACHING CHILDREN

Just as I was thinking about ending the year and wondering how to convince myself that the children were learning, I received a new Commentary on how important it is to remind children of how much they are learning. It stimulated me to engineer a pedagogical happening.

I asked the children to think of something they had learned which they wanted to teach younger children. They worked alone or with small groups, and there was much advance planning and anticipation. They wrote down what they wanted to teach, the materials they needed, and what they hoped their pupils would learn. (In view of my own concerns about what children learn, this was a rather facetious question on my part. I got useless answers like, "the same thing I learned.")

The range of topics chosen was wide, and the majority did something with crystals or mystery powders. The younger children were delighted with the attention and the opportunity to be a part of the activities in the "science room" which they had always watched with jealous interest from the hall.

I was free to observe because the groups came *ad seriatim* during the day. As they "taught," I watched. An example of insight into teaching came from two older children who had planned an elaborate electricity project involved blinking lights and fortune-telling. The younger children were quite compliant, but had to be manipulated because they really didn't know what was going on. The older children were aware that they had missed the mark and were clearly concerned. One of them said with real empathy, "I wonder if teachers always feel this awful when their children don't understand?"

Another child lectured a five-year-old on electricity. The five-year-old had a particularly short attention span, and he did not conceal his wandering attention. The eight-year-old child was angry. She is very obedient and cannot imagine ignoring anyone's proffered information. She said with uncharacteristic feeling, "I guess he wasn't interested."

These were two conspicuous "failures" which resulted in increased understanding, though most of the children succeeded masterfully in teaching something they knew.

One child was genuinely expert in electricity; in fact, he was often rejected by the other children in part because of his continually self-proclaimed expertise. He was able to share for an hour, almost nonverbally in the construction of a circuit board. That he could allow the younger child an active role without barraging him with words (eliminating the barrage of words was something I had been working on all year) was tremendously satisfying to everybody.

Some children were much more precise about their projects than I had ever suspected. Had I not had this opportunity to observe, I would havenever known that the crystal gardens involved a sequence of steps that were not at all random. Layers of salt, alcohol, and food coloring dripped in a certain way to produce those rock-like formations the children had seen in Utah.

In observing all 80 children, I saw that their learning was secure in the particular area they chose. They were also alert to new possibilities. Children who had chosen to teach how to make a solution with salt and food coloring in order to grow a crystal were now noticing the way the food coloring diffused differently in salt water than in plain water. The boys who always wanted the explosions and bombs were able to supervise heating sugar over Sterno without abusing the privilege. One child developed such agility in controlling the heat, he was able to heat the sugar to four different temperatures all on the same piece of foil. The younger children were fascinated and each child was able to make a piece of candy.

The child who made the canopy bed had made a whole model bedroom. It had taken her most of the year. It had taken a month to solve the problems of the bed for herself, but secure and confident in her skills, she was able to teach a child how to make a bed in one period.

Another child showed his growth in teaching three six-year-olds how to make some amazing broom-stick puppets he had invented. He started in my program having a temper tantrum when I didn't have the materials he needed. At the end of two years, though his products did not look too much different, he was able to think of alternatives on his own and become adaptably imaginative in his use of materials. He had taken four class periods of solid work to make his own puppet, devising each step out of his head with the materials on hand. That he was able to share his invention and help three delighted children make similar puppets convinced him and everyone else of his progress.

Even one of the children who had been a part of that competitive clique who rarely got involved with the materials latched onto a more involved group for his teaching project. I could see his eyes bug out when he was forced by circumstances to pay attention to what was going on. (He may be one of those children for whom open structure is not the best form of education. His metier was speed in workbooks.)

I saw children say to their pupils: "What do you think will happen?" and "What else could you do with that?" I even saw the case of Liza, which warmed my heart. As far back as nursery school, Liza had dreamt her head was smashed to pieces because she couldn't remember all of what she was being taught. At 10 years, she was still intellectually timid and afraid of learning. In my class she grew steadily, but the following year I saw her listening to some of the younger children reminiscing about when they were "taught crystals" by the children in my program. She said, with supreme confidence and pride, "Nobody taught me how to grow crystals. I taught myself."

CONCLUSION

On the one hand I feel like Liza: nobody taught me to teach, I taught myself. On the other hand, without the seminars I might be just an experienced teacher, teaching *The Iliad* for the tenth time. The seminar was a source of support as well as the start of a powerful process of growth. Many teachers have a difficult time understanding and accepting such an open-ended enterprise as I had in my classroom; before the seminar I was one of those teachers. I was fascinated by the descriptions of children's encounters with materials and the way teachers focused on their thinking, but frankly I couldn't figure out where in the schedule they would have time for that kind of exploration. It was all right to abandon my plans once in a while, but I had not been ready to give children enough latitude while they fumbled and went through spurts of false starts. It was the seminar--the model of experienced teachers and the individual examples of children's eventual successes--that gave me the courage to stick with a method which on the surface looks random and inefficient.

I am aware that the kinds of successes I saw in my program still raise some questions with which all concerned educators struggle. I saw more clear examples of children's independence, flexibility, and toleration of ambiguity than I did of children acquiring concepts. No one knows for certain what kind of conceptual knowledge, if any, is appropriate for 6-to-12-year-olds. We ought to know and the fact that we don't indicates some of the distance we have to go yet in learning how to work with children. But the answers to those questions, when they come, are more likely to be provided by classroom teachers than by academicians working under rigorous, experimental conditions or by theoreticians removed from children. And perhaps they will be teachers working in seminars, generating specific examples and recording them in their own commentaries.

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